SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	ENGINEERING
1.3 Department	DEPARTMENT OF AUTOMATION, INDUSTRIAL ENGINEERING AND TEXTILES
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Name of the discipline	POWER ELECTRONICS
2.2 Course activity holder	Prof.univ.habil.dr.eng. Marius Mircea BĂLAȘ
2.3 Instructor of the laboratory/project activity	Senior Lecture dr.eng. Flavius-Maxim PETCUȚ Assistant univ.drd. Daniel ALEXUȚĂ
2.4 Year of study	4
2.5 Semester	1
2.6 Type of assessment	EXAMINATION
2.7 Discipline regime	DSC-compulsory

3. Estimated total time (hours per semester of teaching activities**)**

3.1 Number of hours per week	4	of which 3.2 course	2	3.3 laboratories+project	2
3.4 Total hours in the curriculum	56	of which 3.5 course	28	3.6 laboratories+project	28
Distribution of the time fund					hours
Study by textbook, course material, bibliography and notes					25
Additional documentation in the library, on specialized electronic platforms and in the field					24
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					16
Tutorial					2
Examination					2
Other activities...					
3.7 Total hours of individual study					69
3.8 Total hours per semester					125
3.9 Number of credits					5

4. Preconditions (acolo unde este cazul)

4.1 of curriculum	Electrical Engineering, Physics, Mathematical Analysis, Non-Meric Methods, Linear Electronic Circuits, Digital Electronics.
4.2 of competences	Basic concepts from Linear Electronic Circuits, Digital Electronics, Control Engineering, Electrical Machines and Drives.

5. Conditions (where applicable)

5.1 course	Interactive whiteboard, Electronics Workbench.
5.2 laboratory/project	General Purpose Electronic Laboratory Equipment, Infinit Technologies power electronics trainer base unit IT-2200ies Stand. Software (free): Electronics Workbench.

6. Specific competences acquired

Professional competences	C2. Design electronic systems: Is able to identify, describe and creatively apply the operating principles of electronic power circuits (uncontrolled/controlled rectifiers, inverters with different waveforms, DC-DC and AC-AC converters, variable speed drives, etc.) C7. Perform laboratory tests: Plan and execute engineering experiments using specific laboratory equipment. Analyzes and interprets experimental data to validate hypotheses or technical performances. Is able to correctly and creatively use laboratory instrumentation (oscilloscope, signal generator, etc.) for testing and performance evaluation. Methodological and organizational skills: • Is able to plan and carry out experimental laboratory activities according to established procedures. • Has the ability to organize and manage the human and technical resources necessary for design, testing and automated production.
Transversal competences	CT3. Think analytically: • Think analytically. • Think critically. • Think creatively.

7. Learning Outcomes

Knowledge	• Knowledge of electronic schematics and methods of designing of electronic power equipment. • Knowledge in electronic circuit simulation programs. • Use of specific laboratory equipment. • Data analysis and interpretation. • Processes information, ideas and concepts. • Solve problems. • Think creatively and innovatively.
Skills	• Makes electronic power diagrams using CAD. • Performs simulations to verify the functionality and viability of systems designed prior to manufacturing. • Plans and executes engineering experiments using specific power electronics equipment in the laboratory. • Analyzes and interprets experimental data for the validation of hypotheses or technical performances. • Recognizes the electronic power converters, selects the most suitable ones, can implement and optimize them. • Think analytically.
Responsibilities and autonomy	• It evaluates and optimizes the performance of the designed system, taking responsibility for the choice of technical solutions.

	• Can work independently or in a team to implement and test automation solutions in a real professional environment. • Manage technical projects responsibly and on time. • Has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). • Approach problems critically.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	Power Electronics aims to provide students with basic knowledge in the field of power electronics, with a focus on the most important types of converters (Buck, Boost, Buck-Boost, Flyback, Push-Pull, etc.), with multiple applications in the construction of stabilized power supplies for IT as well as for automation equipment and various types of drives (cc-cc, ca-ca, voltage, current, speed, etc.).
8.2 Specific objectives	• Knowledge of the fundamental schemes of power electronics; • Developing the skills of analysis and synthesis of electronic power converters; • Develop practical skills for commissioning, setting up and maintaining industrial electronic equipment; • It has the ability to integrate power converters into complex applications: power supplies, electric drives, renewable energy systems, electric vehicles, etc. • Correlation of thehourstical models with experimental results, through the interpretation and analysis of the data obtained.

9. Conţinuturi

9.1 Course	**Teaching methods**	**Observations**
1. Conversion of electricity. Power electronic devices.	Interactive whiteboard display	2 hours
2. Rectifiers (uncontrolled/controlled, single-phase/two-phase/three-phase)	Interactive whiteboard display	2 hours
3. Inverters (sinusoidal, rectangular, modified sinusoidal, PWM, etc.)	Interactive whiteboard display	2 hours
4. Switching power supplies: Buck, Boost, Buck-Boost, Flyback, Push-Pull.	Interactive whiteboard display	4 hours
5. Voltage stabilizers	Interactive whiteboard display	2 hours
6. Linear power supplies, integrated voltage stabilizers: LM723	Interactive whiteboard display	2 hours
7. Three-Terminal Stabilizers: LM78xx, LM117, LM317	Interactive whiteboard display	2 hours
8. Variable speed drives for DC and AC electric motors	Interactive whiteboard display	4 hours
9. Industrial Integrated Circuits	Interactive whiteboard display	4 hours
10. Applications: photovoltaic panels, electric and hybrid automobiles, etc.	Interactive whiteboard display	4 hours
	TOTAL	**28 hours**

Course bibliography	1. M. Bălaș. „Introducere în electronică. Circuite electronice liniare.” Editura Universităţii Aurel Vlaicu din Arad, 2013. 2. M. Bălaș. "Power electronics." Course material, electronic version, 2025. 3. M. Bălaș. "Power electronics. Laboratory Tutor", electronic version, 2025. 4. „Advanced Power Electronics Trainer It-9500-1. Experiment Manual.” Infinit Technologies. 5. M.H. Rashid. „Power Electronics Handbook.” Third edition, Elsevier, 2011.

9.2 Laboratory	**Metode de predare**	**Observaţii**
1. Thyristor 2. LM723 Stabilizer 3. Buck Switching Converter and Source 4. Buck-Boost Converter and Source 5. Flyback Converter & Source 6. Integrated bridges and control circuits 7. LM555 timer inverters for fluorescent lighting	Interactive whiteboard displays, circuit design and testing.	Each laboratory takes 2 hours
	TOTAL	**14 hours**
Laboratory bibliography	1. M. Bălaș. „Electronică de putere. Îndrumător de laborator.” Suport de curs, variantă electronică, 2025. 2. „Advanced Power Electronics Trainer It-9500-1. Experiment Manual.” Infinit Technologies.	

9.2 Project	**Metode de predare**	**Observaţii**
1. Tehnica PWM (Puse Width Modulation) 2. Formulation of individual themes 3. Project design 4. Simulation of schemes 5. Analyze and validation 6. Testing of validated projects 7. Project presentation and evaluation	Interactive whiteboard displays, circuit design and testing.	Each laboratory takes 2 hours
	TOTAL	**14 hours**
Project bibliography	1. M. Bălaș. „Power electronics. Laboratory Tutor." Course material, electronic version, 2025. 2. „Advanced Power Electronics Trainer It-9500-1. Experiment Manual.” Infinit Technologies.	

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers' representative in the field related to the program

The content of the discipline is in line with what is done in other university centers in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad.

The discipline is developed on the basis of internationally recognized field textbooks.

- some of the examples presented during the course, laboratory and seminar were debated at national and international conferences and lectures;
- the promotion of the teaching degree to the position of teacher was made on the basis of publications in the field.

11. Assessment

Type of activity	Evaluation criteria	Evaluation method	Percentage the final grade
11.1 Course	Acquiring theoretical knowledge, understanding the fundamental principles of analysis and synthesis of electronic power circuits.	Written examination, with subjects taken from the course. Activity at the course.	50%
11.2 Laboratory	Theoretical training and prior documentation, laboratory work, compliance with safety regulations, quality and accuracy of measurements and reporting of results.	Verification along the way. Laboratory activity.	25%
11.3 Project	Analyzing the theme chosen by the student, the proposed solutions, the realization and drafting of the project.	Project presentation and evaluation.	25%

11.4 Minimum performance standard

In order to obtain the minimum passing grade, the student must meet the following minimum performance standards, in accordance with the learning outcomes declared for the subject:

1. Knowledge of the fundamental concepts of power electronics: the main types of power semiconductor devices (power diode, transistors/MOSFETs/IGBTs, thyristors), the essential parameters of power devices and their operating regimes, the classification of converters (AC–DC, DC–DC, DC–AC, AC–AC).

2. Application of standard methods of power converter analysis: analysis of uncontrolled and controlled rectifiers, determination of average and effective voltages and currents in simple converters, understanding the operation of basic single-phase inverters.

3. Solving elementary power electronics problems: evaluating waveforms for elementary switching circuits, making the operating diagram for a simple rectifier or inverter.

4. Correct use of specific technical terminology: switching, conduction, phase control, ripple factor, efficiency, continuous/discontinuous conduction mode, etc. Major conceptual errors regarding the operation of devices or converters are incompatible with promotion.

5. Interpretation of results and correlation with physical principles. The student must be able to interpret the current and voltage waveforms characteristic of elementary converters, physically argue the operating regime of a power semiconductor device, identify elementary problems such as overload, improper conduction or incorrect control.

Students must obtain a grade greater than or equal to 5 both in the written exam (50% weight) and in the laboratory (25% weight) and project (25% weight).

Date of completion Signature of the course holder Signature of the laboratory/project instructor

20.09.2025 Prof.univ.habil.dr.eng. Marius Mircea Bălaș Senior Lecture dr.eng. Flavius M. Petcuț

Assist.drd. Daniel Alexuță

Date of approval in the department 26.09.2025

Signature of the department director
Assoc.prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council 29.09.2026

Approval from the Dean
Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	ENGINEERING
1.3 Department	DEPARTMENT OF AUTOMATION, INDUSTRIAL ENGINEERING AND TEXTILES
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Cycle of studies	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Name of the discipline	FUZZY SYSTEMS AND NEURAL NETWORKS
2.2 Course activity holder	Prof.univ.habil.dr.eng. Marius Mircea BĂLAȘ
2.3 Instructor of the laboratory/project activity	Senior lecture.dr.eng. Flavius Maxim PETCUȚ
2.4 Year of study	4
2.5 Semester	2
2.6 Type of assessment	EXAMINATION
2.7 Discipline regime	DS-compulsory

3. Estimated total time (hours per semester of teaching activities)

3.1 Number of hours per week	4	of which 3.2 course	2	3.3 laboratories/project	2
3.4 Total hours in the curriculum	56	of which 3.5 course	28	3.6 laboratories/project	28

Distribution of the time fund	hours
Study by textbook, course material, bibliography and notes	25
Additional documentation in the library, on specialized electronic platforms and in the field	24
Preparation of seminars/laboratories, assignments, papers, portfolios and essays	16
Tutorial	2
Examination	2
Other activities...	
3.7 Total hours of individual study	69
3.8 Total hours per semester	125
3.9 Number of credits	5

4. Preconditions (where applicable)

4.1 of curriculum	Mathematical Analysis, Linear Algebra, Computer Programming, Modeling Identification and Simulation, Control Engineering, Artificial Intelligence.
4.2 of competences	Knowledge of Control Engineering and Artificial Intelligence.

5. Condiţii (acolo unde este cazul)

5.1 course	Interactive whiteboard, Electronics Workbench.
5.2 laboratory/project	Interactive whiteboard, Electronics Workbench.

6. Specific competences acquired

Professional competencies	C5. Design electronic systems: • Understanding the fundamental concepts of fuzzy logic and artificial neural networks, as well as the relationships between them and classical control and modeling systems. • They can represent linguistically modeled knowledge in the computer. • The ability to model, analyze and synthesize non-linear, uncertain or poorly determined processes with fuzzy, neu ral or hybrid methods. • Design and implementation of fuzzy systems (Mamdani, Sugeno) for control, decision and classification applications. • Design of hybrid neuro-fuzzy systems for intelligent control. • The ability to choose and apply appropriate methodologies for the design and training of fuzzy systems and neural networks, depending on the type of problem (classification, estimation, control, prediction).
Transversal competencies	CT3. Think analytically: • Think analytically. • Think critically. • Think creatively.

7. Learning Outcomes

Knowledge	• Understands the basic and advanced principles of automatic control (feedback, stability, adjustment) and their application in the design of automated systems affected by nonlinearity and uncertainty. • Know the structure, operation and interaction of hardware and software components in an industrial control system (sensors, actuators, controllers, interfaces).
Skills	• Design automatic control structures for industrial processes using mathematical models and performance criteria. • Integrates and configures hardware components (PLCs, microcontrollers, industrial communication networks) and software into a functional automatic control/control system.
Responsibilities and autonomy	• Evaluates and optimizes the performance of the designed system, assuming responsibility for choosing technical solutions. • Can work independently or in a team to implement and test automation solutions in a real professional environment. • Ability to manage technical projects responsibly and on time. • Has availability for continuous learning and adaptation in emerging areas (intelligent automation, IoT, AI in control).

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	The discipline Fuzzy Systems and Neural Networks aim to form the thehourstical and applicative competencies necessary for the understanding, projection and implementation of intelligent systems

	capable of processing uncertain, incomplete or nonlinear information. The main aim is to develop students' ability to use the concepts of fuzzy logic and neural learning for the modelling, identification and control of complex processes, as well as for their application in areas such as control engineering.
8.2 Specific objectives	At the end of the course, the student will be able to: • Explain the fundamental concepts of fuzzy logic and systems. • Build useful fuzzy Mamdani or Sugeno systems with proper language rules and membership functions. • Integrate fuzzy and neural concepts into hybrid structures (neuro-fuzzy), capable of adaptation and learning. • Use specialized software (Matlab Fuzzy Logic Toolbox, Neural Network Toolbox) for application simulation and testing. • Develop application projects that involve modeling and modeling intelligent systems for real applications.

9. Course Content

9.1 Course	**Metode de predare**	**Observaţii**
11. Fuzzy sets, fuzzy logic, membership functions. Norms t-s. Fuzzy indicators	Interactive whiteboard display	4 hours
12. Fuzzy variable. Cognitive frames and fuzzy partitions	Interactive whiteboard display	4 hours
13. Fuzzy controllers. Mamdani and Takagi-Sugeno controllers	Interactive whiteboard display	2 hours
14. Inference methods, rule bases, McVicar-Whelan tables	Interactive whiteboard display	2 hours
15. Metode de defuzzyficare (MOM, COG)	Interactive whiteboard display	2 hours
16. Fuzzy-PID regulators	Interactive whiteboard display	2 hours
17. Fuzzy-interpolative controllers	Interactive whiteboard display	2 hours
18. Neural networks	Interactive whiteboard display	2 hours
19. Neuro-fuzzy controllers	Interactive whiteboard display	4 hours
20. Applications	Interactive whiteboard display	4 hours
	TOTAL	**28 hours**
Course bibliography	6. M.M. Bălaș: „Regulatoare fuzzy-interpolative”, Ed. Politehnica, Timișoara, 2002. 7. M.M. Bălaş, „Curs de Sisteme fuzzy și rețele neuronale” – variantă electronică, 2025. 8. M.M. Bălaş, „Sisteme fuzzy și rețele neuronale. Tutorial” – variantă electronică, 2025. 9. Editors Bogdan M. Wilamowsi, J. David Irwin. „Intelligent Systems”. The Industrial Electronics Handbook, second edition, Taylor and Francis, 2011.	

9.2 Laboratory	Teaching methods	Observations
1. Mulţimi, logică şi variabile fuzzy. 2. Inferenţa fuzzy. Baze de reguli 3. Defuzzyficări MOM şi COG 4. Toolkit-ul Matlab FIS 5. Controlere fuzzy-interpolative 6. Sisteme neuro-fuzzy 7. Toolkit-ul Matlab ANFIS	Interactive whiteboard displays, models design and testing.	Each work takes 2 hours
	TOTAL	**14 hours**
Laboratory bibliography	3. M.M. Bălaş, „Course on Fuzzy Systems and Neural Networks" – electronic version, 2025. 4. M.M. Bălaş, „Fuzzy systems and neural networks. Tutorial" – electronic version, 2025.	

9.3 Project	Teaching methods	Observations
1. Analysis of individual project themes 2. Project design and guidance 3. Implementation of projects 4. Completion of projects 5. Testing and proofreading of projects 6. Project optimization 7. Presentation and assessment of projects	Interactive whiteboard displays, models design and testing.	Each work takes 2 hours
	TOTAL	**14 hours**
Project Bibliography	1. M.M. Bălaş, „Course on Fuzzy Systems and Neural Networks" – electronic version, 2025. 2. M.M. Bălaş, „Fuzzy systems and neural networks. Tutorial" – electronic version, 2025.Editors Bogdan M. Wilamowsi, J. David Irwin. „Intelligent Systems". The Industrial Electronics Handbook, second edition, Taylor and Francis, 2011.	

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers' representative in the field related to the program

The content of the discipline is in line with what is done in other universities in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad.

The discipline is developed on the basis of internationally recognized field textbooks.

- some of the examples presented during the course, laboratory and seminar were debated at national and international conferences and lectures;
- the promotion of the teaching degree to the position of teacher was made on the basis of publications in the field.

11. Assessment

Type of activity	Evaluation criteria	Evaluation method	Percentage the final grade
11.1. Course	Acquiring theoretical knowledge, understanding the fundamental principles of neuro-fuzzy systems. The ability to synthesize and design applications.	Written exam. Course activity.	50%
11.2. Laboratory	Theoretical training and prior documentation, practical work in the laboratory, documentation and reporting of results.	Verification along the way.	25%
11.3. Project	Ability to synthesize and design applications.	Presentation and assessment of projects.	25%

11.3 Minimum performance standard

In order to obtain the minimum passing grade, the student must meet the following minimum performance standards, in accordance with the learning outcomes declared for the subject:

1. Minimum theoretical knowledge. The student must demonstrate the ability to define the fundamental notions of fuzzy logic: fuzzy sets, membership functions, fuzzy operators, to explain the components of a fuzzy system: fuzzification, inference engine, defuzzification, to describe the structure of an artificial neuron and the basic architectures of neural networks (perceptron, MLP), to present the principle of learning through the backpropagation algorithm and to formulate the conceptual differences between fuzzy systems, neural networks and neuro-fuzzy systems.

2. Minimum practical skills. The student must be able to build a fuzzy system like Mamdani or Sugeno, build and train a basic neural network, interpret error curves and check if the network reaches a minimum convergence and use a software environment (MATLAB/Python type) for elementary implementations.

3. Problem solving. The student must demonstrate that they can apply a fuzzy or neuronal model for a simple problem and can select the type of model (fuzzy/neural) appropriate for an application.

4. Analysis and interpretation: The student must be able to explain the limits of an implemented fuzzy or neural model, identify possible sources of error (insufficient fuzzy rules, overlearning at networks) and provide a minimal interpretation of the relationship between inputs and outputs.

5. Technical communication skills. The student must demonstrate the ability to describe the steps taken in the design of a model and correctly present the main parameters (appearance functions, number of neurons, learning rates, etc.).

Students must obtain grades higher than 5 in the course (50% weight%), in the laboratory (25% weight) and in the project (25% weight).

Date of completion Signature of the course holder Signature of the laboratory holder
20.09.2025 Prof.univ.habil.dr.eng. Marius Mircea Bălaș Senior lect.dr.eng. Flavius Maxim Petcuț

Date of approval in the department 26.09.2025	Signature of the department director Assoc.prof. dr.eng. Valentin Dan Mulller
Date of approval in the faculty council 29.09.2026	Approval from the Dean Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	ENGINEERING
1.3 Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORT
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Cycle of studies	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title	CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS
2.2 Course activity holder	Prof.univ.habil.dr.eng. Valentina E. BĂLAȘ
2.3 Laboratory activity instructor	Senior Lecturer.dr.eng. Flavius-Maxim PETCUȚ
2.4 Year of study	4
2.5 Semester	1
2.6 Type of assessment	Summative - EXAM
2.7 Discipline regime	DS - compulsory

3. Total estimated time (hours per semester of teaching activities)

3.1 Number of hours per week	4	of which 3.2 course	2	3.3 Laboratory	2
3.4 Total hours in the curriculum	56	of which 3.5 courses	28	3.6 Laboratory	28

Distribution of the time fund	Hours
Study by textbook, course material, bibliography and notes	25
Additional documentation in the library, on specialized electronic platforms and in the field	20
Preparation of seminars/laboratories, assignments, papers, portfolios and essays	10
Tutorial	7
Examination	3
Other activities...	4
3.7 Total hours of individual study	**69**
3.8 Total hours per semester	**125**
3.9 Number of credits	**5**

4. Preconditions (where applicable)

4.1 Curriculum	Mechanics, mechatronics.
4.2 Competences	Notions of Automatics.

5. Conditions (where applicable)

5.1 Course Schedule	Interactive whiteboard, laptop and appropriate software.

5.2 Conducting the seminar/laboratory	Laboratory room, properly equipped: computers, network, Internet connection, specialized software.

6. Specific competencies acquired

Professional competencies	**C3. Include new products in the production process** **C5. Design control systems**.
Transversal competencies	**CT1. Work in teams**:

7. Learning Outcomes

Knowledge	• He has knowledge of the operation of some methods, algorithms, equipment. • Identify how certain products can be included in production • Understands the basic and advanced principles of automatic control (feedback, stability, tuning) and their application in the designof automated themes. • Know the structure, operation and interaction of hardware and software components in an industrial control system (sensors, actuators, controllers, interfaces). • Know the principles and stages of teamwork • Know ways to communicate and collaborate effectively
Skills	• Documents and implements procedures for introducing a new product into the manufacturing flow. • It ensures the training of operators and the adaptation of equipment to the requirements of the new product. • Design automatic control structures for industrial processes using mathematical models and performance criteria. • Integrates and configures hardware components (PLCs, microcontrollers, industrial communication networks) and software into a functional automatic control/control system. • Participates in team activities, contributing to the achievement of common goals. • Demonstrates the ability to negotiate and resolve conflicts constructively.
Responsibilities and autonomy	• Evaluates and optimizes the performance of the designed system, asuI am responsible for choosing technical solutions. • Can work independently or in a team to implement and test automation solutions in a real professional environment. • Has the ability to manage technical projects responsibly and on time. • It has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). • Assumes his/her own tasks and respects the deadlines set in the team • Contribute to a positive and productive team climate.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General Purpose of the Plina Disc	The management of SFF flexible manufacturing systems aims to develop skills to design, plan, analyze and integrate flexible manufacturing processes within companies.
8.2 Specific objectives	• Understanding the structure: Assimilating knowledge of the components of a flexible manufacturing system (CNC machine tools, industrial robots, automatic transport and handling systems, measurement and testing systems). • Performance analysis and evaluation: The ability to structurally-functionally analyze such systems and evaluate their performance, including identifying and removing production bottlenecks. • Design and configuration: Acquiring methods for designing, sizing and optimally configuring flexible manufacturing systems (SFFs) to meet changing production requirements (different volumes, rapid product renewal). • Leadership and control: Acquiring the skills to set up and implement systems for the management (control) of industrial processes, including through the use of modern approaches (e.g. Internet of Things - IoT) and specialized software. • Integration and management: Understanding how to integrate robots and other equipment into flexible structures and effective management of information and material flow within them. • Optimization and efficiency: Training skills to optimize the operation of SFFs.

9. Contents

9.1 Course	**Teaching methods**	**Observations**
21. Flexible SFF manufacturing systems. production of material goods.	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
22. SFF structure. Hierarchical organization, functions, classification of the SFF. Specific structures.	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
23. Manufacture.	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
24. Concepts of production organization and mathematical models	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
25. Economic aspects in manufacturing systems	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
26. Automatic manufacturing systems	Exhibition on the interactive whiteboard, discussions to clarify concepts	4 hours

27. Analysis of automatic manufacturing systems	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
28. Assembly systems and division of the manufacturing process	Exhibition on the interactive whiteboard, discussions to clarify concepts	4 hours
29. Representation of the operation of an SFF by the GRAFCET method	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
30. Industry 4.0.	Exhibition on the interactive whiteboard, discussions to clarify concepts	4 hours
31. Modeling the leadership of flexible manufacturing systems and subsystems. Simulation using Petri Nets	Exhibition on the interactive whiteboard, discussions to clarify concepts	2 hours
	TOTAL	**28 hours**
Course bibliography	1. Valentina E. Balas, Control of Flexible Manufacturing Systems, Course notes. Electronic format updated, 2025. 2. Pankaj Bhambri, Sita Rani, Valentina E. Balas and Ahmed A. Elngar, Integration of AI-Based Manufacturing and Industrial Engineering Systems with the Internet of Things. Series: Intelligent Manufacturing and Industrial Engineering, CRC Press, Taylor and Francis Group, 2024 3. Mircea Nitulescu, Flexible Manufacturing Systems, Craiova University Publishing House, 2019. 4. Groover, M., Automation, production systems and Computer Intefrated Manufacturing, Ed. Prentice – Hall, 2014.	

9.2 Laboratory	**Teaching methods**	**Observations**
Students (individually or in teams) are proposed to study and carry out different topics in the courses, solve problems and find scenarios for concrete cases.		
Virtual implementations with the purpose of validating the discussed scenarios, using appropriate Petri nets (one machine – one operator, two machines, one operator, n machines – one operator, n machines, n operators), practical stands.		
Introduction to the use of specific software: Fujitsu, Simio.		
Scroll		**Hours**
8. Choosing or assigning project themes. Initial guidance and discussions	Discussions, documentation, Internet access,	2
9. Documentaries and discussions. Inter-team consultations		4
10. Preliminary presentation. Discussions. Additions. Suggestions.		2

11. Presentation of the chosen theme		6
	TOTAL	**28 hours**
Laboratory bibliography	5. Valentina E. Balas, Control of Flexible Manufacturing Systems, Course notes, electronic version 2025. 6. Mihaela Popa, Control of Flexible Manufacturing Systems, Lab notes, electronic version 2025. 7. Flavius-Maxim Petcuţ, Control of Flexible Manufacturing Systems, Lab notes, electronic version 2025. 8. Simio documentation.	

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in line with what is done in other university centers in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad.
The discipline is developed on the basis of internationally recognized field textbooks.
- Some of the examples presented during the course, laboratory and seminar were discussed at national and international conferences and lectures.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1. Course	Knowledge assessment through a test based on the knowledge acquired following participation in the course	Multiple-Choice Test	50%
11.2 Laboratory	Examination of skills and knowledge agreements obtained from participation in the laboratory	Practical exam	50%
11.3 Minimum Performance Standard Students must obtain a grade greater than or equal to 5 both in the exam (grid test) (50% weight) and in the laboratory (50% weight).			

Date of completion 20.09.2025

Signature of the course holder
Prof.habil.dr.eng. Valentina E. Bălaș

Signature of the laboratory instructor
Senior Lecturer dr.eng. Flavius M. Petcuţ

Date of approval in the department 26.09.2025

Signature of the department director
Assoc.Prof.dr.eng. Valentin Dan Muller

Date of approval in the faculty council
29.09.2026

Approval from the Dean
Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORT
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Study Cycle	BACHELOR OF SCIENCE
1.6. Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title	METHODOLOGY OF SCIENTIFIC RESEARCH
2.2 Course activity holder	Prof.univ.habil.dr.eng. Valentina Emilia BĂLAȘ
2.3 Laboratory activity instructor	Prof.univ.habil.dr.eng. Valentina Emilia BĂLAȘ
2.4 Year of study	4
2.5 Semester	2
2.6 Type of assessment	EXAMINATION
2.7 Discipline regime	DS - compulsory

3. Estimated Total Time (hours per semester of didactic activities)

3.1. Number of hours per week	3	of which 3.2 course	2	3.3 Laboratory	1
3.4. Total hours in the curriculum	42	of which 3.5 courses	28	3.6 Laboratory	14
Distribution of the time fund					Hours
Study by textbook, course material, bibliography and notes					15
Additional documentation in the library, on specialized electronic platforms and in the field					5
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					5
Tutorial					3
Examination					3
Other activities...					2
3.7 Total hours of individual study					**33**
3.8 Total hours per semester					**75**
3.9 Number of credits					**3**

4. Preconditions (where applicable)

4.1. of curriculum	-
4.2. of competences	-

5. Conditions (where applicable)

5.1. Course Planning	

	Active and interactive learning conditions, didactic activities based on heuristic and creative strategies, on problematizing learning situations, but also practical-applicative; Onsite scenario: use of the computer, video projector Classroom, equipped with interactive whiteboard, laptop and appropriate software.
5.2. Conducting the laboratory	Laboratory room, properly equipped: computers, network, Internet connection, specialized software.

6. Specific competencies acquired

Professional competencies	- C1 – Perform analytical mathematical calculations. - C3 – Includes new products in the production process. - C6 – Establishes data processes. - C7 – Perform laboratory tests.
Transversal competencies	- CT1 – Work in teams. - CT2 – Comply with regulations.

7. Learning Outcomes

Knowledge	The student/graduate: • Knows and identifies mathematical methods for modeling and solving engineering problems. • Use specific software tools to automate analytical calculations and verify mathematical solutions in real contexts. • Has knowledge regarding the functioning of some methods, algorithms. • Knows algorithms for data processing and analysis. • Know programming languages. • Understand algorithms and data structures. • Knows and knows how to use specific laboratory equipment • Has knowledge of data analysis and interpretation. • Knows the principles and stages of teamwork. • Knows ways of communication and effective collaboration • Know the principles of professional ethics and deontology. • Is familiar with applicable procedures and quality standards.
Skills	The student/graduate: • Apply advanced mathematical methods for modeling engineering problems. • Use specific software tools (VOSViewer, MATLAB) to automate calculations. • Document and implement procedures • Create algorithms for data processing and analysis in industrial and engineering applications. • Use programming languages and ICT tools to transform raw data into useful information. • Plan and execute specific laboratory experiments

	• Analyzes and interprets experimental data to validate hypotheses or performances. • Actively participates in team activities, contributing to the achievement of objectives • Correctly apply the regulations, procedures and restrictions specific to the activity. Propose solutions to improve rules and procedures.
Responsibilities and autonomy	The student/graduate: • Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. • Evaluates and optimizes the performance of the designed system. Can work independently or in a team to implement and test automation solutions in a real professional environment. • Has the ability to manage technical projects responsibly and on time. • It has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). • Assumes his/her own tasks and respects the deadlines set by the team. • Respects the principles of professional ethics in all activities. • Contributes to the promotion of an organizational culture based on compliance and integrity. • Approaches problems critically. • Analyzes experimental laboratory data.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	The main objective of the discipline is to form the skills necessary for the design, organization, conduct and rigorous presentation of scientific research, by understanding the methodological principles, the stages of research and the specific tools used in the production of scientific knowledge.
8.2 Specific objectives	- Understanding the stages of scientific research, from formulating the problem and hypotheses to analyzing, interpreting and disseminating the results. - To develop the ability to identify and define a research problem, through critical analysis, argumentation and theoretical substantiation. - Development of the ability to develop a research plan (experimental design, method, tools, sampling, data collection procedures). - Acquisition of techniques of search, selection and analysis of scientific literature, including the use of scientific databases and evaluation of the quality of sources. - Training of skills in the use of qualitative and quantitative methods, adapted to the specifics of the research field.

	- Developing the ability to write scientific texts (articles, reports, dissertation/doctoral papers) using standardized structures and appropriate academic style. - Understanding the principles of research ethics, the responsibilities of the researcher and compliance with the norms of academic integrity. - Familiarity with modern methods and tools of analysis, including statistical software, bibliography management applications and digital research tools. - Training the ability to interpret and present data and results, using relevant tables, graphs and statistical indicators. - Developing the ability to orally support a research project, through reasoned, clear and professional presentations.

9. Content

9.1 Course	**Teaching methods**	**Observations**
1. Introduction. What is research.	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
2. Literature review	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
3. Quotes	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
4. Intellectual property right	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
5. Research ethics	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
6. Technical writing and publishing	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
7. Research, planning and collaboration management	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours

8. Communication of research	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
9. Bibliometrics and research quality	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
10. Case studies. Fundamental research and technology transfer. Romanian grants, European funds,	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
	TOTAL	**28 hours**

Course bibliography:

1. Valentina E. Balas, Methodology of scientific research, course support – electronic version 2025.
2. D. Deb, R. Dey, V.E. Balas, Engineering Research Methodology. A Practical Insight for Researchers, Springer, 2019.
3. International databases accessible through Enformation (Web of Science, Springer, Scopus).
4. Access to the IEEE database, Research Gate, ORCID.
5. VOSviewer software.

9.2 Laboratory	**Teaching methods**	**Observations**
1. Scientometry	Problem solving and computer modeling+simulation using the Matlab PN Tool environment	2 hours
2. Types of financing	Problem solving and computer modeling+simulation using the Matlab PN Tool environment	2 hours
3. International databases. Documentation	Problem solving and computer modeling+simulation using the Matlab PN Tool environment	2 hours
4. Specialized journals and scientific conferences	Problem solving and computer modeling+simulation using the Matlab PN Tool environment	2 hours
5. Literature Review Topics	Problem solving and computer modeling+simulation using	4 hours

	the Matlab PN Tool environment	
6. Recoveries	Problem solving and computer modeling+simulation using the Matlab PN Tool environment	2 hours
	TOTAL	14 hours

Laboratory bibliography:

1. Valentina E. Balas, Methodology of scientific research, course support and laboratory – electronic version 2025.
2. D. Deb, R. Dey, V.E. Balas, Engineering Research Methodology. A Practical Insight for Researchers, Springer, 2019.
3. International databases accessible through Enformation (Web of Science, Springer, Scopus).
4. Access to the IEEE database, Research Gate, ORCID.
5. VOSviewer software.

10. Corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in accordance with what is done in other university centers in the country and abroad.
In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad.
The discipline is developed on the basis of internationally recognized field textbooks.
Some of the examples presented during the course and the laboratory were discussed at national and international conferences and lectures.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Knowledge, correctness of knowledge	Written Paper	60%
	Understanding and assimilating the language of specificity		
11.2 Laboratory	- knowledge and understanding; - the ability to explain and interpret some methods; - complete and correct resolution of requirements.	- activity with a predilection for applications, practical works, projects. - Control Themes - scientific activities	Evaluation of laboratory activities 30%
			Active presence 10%

11.3 Minimum Performance Standard
1. The student proves that he knows the main concepts, recognizes them, defines them correctly and can solve a simple application. 2. Use specialized language. 3. Minimum grade 5 in the laboratory and minimum grade 5 in the written paper.

Date of completion	Signature of the course holder	Signature of the laboratory instructor
20.09.2025	Prof.habil.dr.eng. Valentina E. Balaș	Prof.habil.dr.eng. Valentina E. Balaș

Date of approval in the department	Signature of the department director
26.09.2025	Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council	Approval from the Dean
29.09.2026	Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	FACULTY OF ENGINEERING
1.3 Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title:	PROJECT MANAGEMENT
2.2 Course Lecturer:	Senior Lecturer dr.eng. George Cătălin CRIȘAN
2.3 Seminar/Laboratory Instructor:	Senior Lecturer dr.eng. George Cătălin CRIȘAN
2.4 Year of Study:	4
2.5 Semester	1
2.6 Type of Assessment:	EXAMINATION
2.7 Course Status:	DS-compulsory

3. Estimated Total Time (hours per semester of didactic activities)

3.1 Hours per week	4	of which 3.2 lecture	2	3.3 Project	2
3.4 Total hours in the study plan	56	of which 3.5 lecture	28	3.6 Project	28

Time allocation:	Hours
Study based on course materials, bibliography	22
Additional documentation in library, specialized databases, or field work	0
Preparation for seminars/labs, essays, portfolios	20
Tutoring	0
Examinations	2
Other activities...	0
3.7 Total hours of individual study	44
3.8 Total hours per semester	100
3.9 Number of credits	4

4. Preconditions (where applicable)

4.1 of curriculum	This is not the case
4.2 of competences	This is not the case

5. Conditions (where applicable)

5.1 of conducting the course	Smart Whiteboard Classroom
5.2 of conducting the project	Smart Whiteboard Classroom

6. Specific skills acquired

Professional competencies	C5. Design control systems
Transversal competencies	CT1. Work in teams - Work confidently within a group, each doing their part in the service of the whole. CT2. Comply with regulations - Comply with the rules, regulations and guidelines relating to a specific field or sector and apply them in their daily work.

7. Learning Outcomes

Knowledge	The graduate must: • knows the fundamental principles of project management, including the project life cycle and the processes of initiation, planning, execution, monitoring & control, closure; • understand and be able to apply the models and methodologies used in European projects (e.g. PM², project cycle management, intervention logic, etc.); • identify and analyse the types of EU funding programmes (e.g. Erasmus+, Structural and Cohesion Funds, HORIZON, LIFE, etc.), the eligibility criteria, the objectives and priorities of the programming cycles; • make appropriate use of specialist language in EU project management, including terms such as 'result indicator', 'impact', 'eligible activity', 'indirect cost', 'co-financing', 'partnership', 'dissemination', etc.; • master the funding mechanisms and the reporting, monitoring and auditing rules specific to European projects; • understands organizational phenomena and managerial processes (human resources, communication, risk, stakeholders) in the context of project implementation. • knows the principles and stages of teamwork. • is familiar with the applicable procedures and quality standards.
Skills	The graduate must: • carry out the analysis of EU funding calls, identifying the right programme and correctly interpreting the requirements, priorities and selection criteria; • develop a project proposal including objectives, activities, budget, indicators, as well as a monitoring and dissemination plan; • make appropriate use of EU-specific language and format in proposal documentation and reports; • plan and manage the human, financial and material resources necessary for the implementation of the project; • monitor progress and evaluate results, adapting the plan according to slippages or risks identified; • effectively manage relations with stakeholders (partners, beneficiaries, funder, authorities). • organise financial control and reporting (interim and final) in accordance with EU requirements.

	• interpret organizational situations and make appropriate managerial decisions in the context of project constraints (deadlines, limited resources, conflict, risk). • correctly apply the specific regulations, procedures and instructions of the activity.
Responsibilities and autonomy	The graduate must: • takes responsibility for the correct implementation of the project, in accordance with the requirements of the funder (compliance with procedures, deadlines and budget); • work independently in the management of project phases, with minimal coordination, anticipating risks and taking corrective actions; • coordinate the project team (or its components) by delegating tasks, monitoring progress and motivating members; • report and justify decisions and expenditure to the funder and audit bodies; • set priorities and manage trade-offs in between, cost and quality; • select and adapt appropriate methods and tools to European projects, with a high level of professional autonomy; • Respect professional ethics (transparency, avoidance of conflicts of interest, integrity) in all phases of the project.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	To provide students with a solid and applicable understanding of European project management, so that they are able to design, implement and monitor projects in line with EU requirements, integrating organisational managerial principles and using field-specific language.
8.2 Specific objectives	• Identify and explain the main methodologies and life cycles applicable to European projects (including: PM², logical framework, project cycle management). • Analyse EU funding calls, identify the appropriate programme and interpret the related priorities and selection criteria. • Formulate project documentation (including objectives, activities, indicators, budget and dissemination plan), using the language and structure required by EU funders. • Plan and manage project resources, optimizing the allocation of human, material and financial resources. • Identify, monitor and manage risks, adapting the diversion response plan. • Coordinate relations with stakeholders, including partners and beneficiaries, ensuring effective communication and compliance with contractual requirements. • Carry out financial and progress reporting, as required by the EU, and justify decisions and expenditure to the funder and audit bodies.

	• To intervene independently in the project stages, taking responsibility for decisions, priorities and trade-offs in the meantime, cost and quality. • Interpret organizational phenomena and apply managerial functions (planning, organization, leadership, control) in the context of project implementation.

9. Contents

9.1 Course	Teaching methods	Observations
Introduction to Project Management • Fundamentals: what is a project, what is project management • The difference between project, program and portfolio • Roles, stakeholders • Success and Failure Factors • Activity: Case discussion – failed / successful project analysis	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	2 hours
Project lifecycle and methodologies • Life cycle stages: initiation, planning, execution, monitoring & control, closure • Model: Waterfall, Agile, PM², Project Cycle Management (PCM) • Intervention Logic / Logical Framework • Activity: Comparison of methodologies applicable in a practical case	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	4 hours
Project initiation / context analysis • How to initiate a project: identification of the need, diagnosis, analysis of the initial situation • SWOT analysis, stakeholder analysis, external/internal environment analysis • Defining strategic and operational objectives • Activity: Conducting a SWOT/stakeholder analysis for a proposed project.	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	2 hours
Project planning — objectives, activities, logic • Formulation of specific objectives, results, SMART indicators • Structuring activities and defining deliverables • Link between objectives, activities and resources • Gantt Chart, WBS (Work Breakdown Structure) • Activity: Elaboration of WBS and Gantt for a mini-project	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	2 hours
Budget and resources • Classification of costs: direct, indirect, eligible, ineligible • Co-financing, cash-flow, amortization	Presentations, presentations, editorial materials (clips, diagrams, graphs,	2 hours

• Allocation of human and material resources • Time and cost buffers • Activity: Creating a detailed budget for the proposed project	presentations) on the smart board	
Risks and risk management • What is risk and what types of risk arise in projects • Identification, assessment (likelihood/impact), response plans • Continuous risk monitoring • Activity: Identification of risks and response plans for the studied project	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	4 hours
Monitoring, control and reporting • How progress is monitored (indicators, periodic reports) • Control methods: Earned Value (EV) variant, deviations, corrective actions • Interim and final reports • Activity: Simulation of comparison of plan vs implementation and proposal of corrective measures	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	2 hours
Quality and its assurance • The concept of quality in projects • Quality standard, procedures, internal audit • Quality control of deliverables • Change management • Activity: Draft quality control procedure for the given project	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	2 hours
Team collaboration and project leadership • Team Building, Roles, Responsibilities • Motivation, delegation, feedback • Project leadership styles • Team dynamics • Activity: Simulation of roles in a project team and behavioral exercises	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	6 hours
Dissemination and sustainability • Dissemination and public communication strategies • Project visibility (branding, EU logo, etc.) • Sustainability plan after the end of the project • Transfer of good practices • Activity: Making a dissemination plan + post-project strategy	Presentations, presentations, editorial materials (clips, diagrams, graphs, presentations) on the smart board	2 hours
	Total	28 hours

Course bibliography	• Diana Elena Ranf, Anca Larisa Ciucă, Project Management – a manual for the field of security and defense, "Nicolae Bălcescu" Land Forces Academy Publishing House, Sibiu, 2021. • Dragoș Marcu, Monica Iorga (Crăciunica), Bogdan Florea, Augustin Semenescu, Project Management, Polytechnic University of Bucharest (modern edition). • Daniela Flores, Management of EU-funded projects • Guide to good practices in project management, published by Romanian institutions and authorities (e.g. ministries, development authorities). • PM² Methodology – Guide v3.0 (Romanian translation). • George Cătălin Crișan, Electronic course on the SUMS platform, 2025.

9.2 Project	**Teaching methods**	**Observations**
Application of project management methods and tools for the development of a complete project.	• Individual and team application work. • Case studies. • Use of digital tools (MS Project, Excel, Canva, Trello, Jira). • Exercises on real scenarios. • One-on-one guidance and feedback. • Interactive presentations and guided discussions. • Incremental construction of a complete project.	
Conducting contextual analyses (SWOT, stakeholders).		
Formulation of SMART objectives, results and indicators.		
Elaboration of the WBS structure and the Gantt chart.		
Building budget and cash-flow.		
Identification and assessment of risks.		
Developing a communication and sustainability plan.		
Drafting progress reports.		
Effective teamwork.		
Supporting the project in the final presentation.		
	Total	28 hours

Project bibliography	• Ranf, D.E., Ciucă, A.L. (2021). Project management – manual for the field of security and defense. "Nicolae Bălcescu" Land Forces Academy Publishing House, Sibiu. • Marcu, D., Iorga (Crăciunica), M., Florea, B., Semenescu, A. (2020). Project management. Polytechnic University of Bucharest. • Flores, D. (2020). Management of projects with European funding. ProUniversitaria Publishing House. • Kerzner, H. (2022). Project Management: A Systems Approach to Planning, Scheduling, and Controlling. 13th Edition, Wiley. • Project Management Institute (PMI). (2021). A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – 7th Edition. • Axelos. (2023). PRINCE2® 7: Managing Successful Projects. The Stationery Office.

	• European Commission. (2021). PM² Guide – Project Management Methodology. v3.0 • George Cătălin Crișan bibliography project uploaded on online platform, 2025.

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

- The content of the course was subject to consultation with project management practitioners (project managers, EU consultants), in order to align the topics with professional realities.
- Views were obtained from representatives of relevant professional associations (e.g. project management or European funding organisations) on the skills required in practice.
- We have revised recent EU calls and funding guides to include current priorities and requirements, ensuring that the content is up-to-date.
- The structure and theme of the course are compared with international standards and recognized methodologies (e.g. PM², PMBOK) to guarantee coherence with the epistemic community.

11. Rating

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Correctness of answers on concepts, methodologies, terminology	Tests	10%
	Application of knowledge to a practical scenario, methodological justifications	Case study	20%
	Ability to communicate, coherence, argumentation, answer questions	Direct observation	15%
	Involvement, contributions to discussions, solving practical exercises	Direct observation	15%
11.2 Project	Complete elaboration of a European mini-project: objectives, activities, indicators, budget, dissemination plan, etc.	Project evaluation	30%
11.3 Minimum Performance Standard Participation in a project team (5-6 members) - mandatory for all review sessions; Coherent presentation of the funding application; The ability to answer two of the questions asked in the final exam.			

Date of completion 20.09.2025
Signature of the course holder Senior lecturer.dr.eng.George C. Crișan
Signature of the project instructor Senior lecturer.dr.eng. George C. Crișan

Date of approval in the department 26.09.2025
Signature of the department director Assoc.prof.dr.eng. Valentin Dan Muller

Date of approval in the faculty council 29.09.2026
Approval from the Dean Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher Education Institution:	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty:	FACULTY OF ENGINEERING
1.3 Department:	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4 Field of Study:	AUTOMATION, APPLIED INFORMATICS, AND INTELLIGENT SYSTEMS
1.5 Study Cycle:	BACHELOR OF SCIENCE
1.6 Study Program / Qualification:	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title:	AUTOMATION OF COMPLEX PROCESSES
2.2 Course Lecturer:	Senior Lecturer dr.eng. DANIEL DRAGU
2.3 Seminar/Laboratory Instructor:	Senior Lecturer dr.eng. DANIEL DRAGU
2.4 Year of Study:	4
2.5 Semester	1
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DS-optional

3. Estimated Total Time (hours per semester of didactic activities)

3.1 Hours per week:	4	of which 3.2 lecture	2	3.3 project	2
3.4 Total hours in the study plan	56	of which 3.5 lecture	28	3.6 project	28

Time allocation:	hours
Study based on course materials, bibliography	10
Additional documentation in library, specialized databases, or field work	10
Preparation for seminars/labs, essays, portfolios	10
Tutoring	5
Examinations	5
Other activities...	4
3.7 Total hours of individual study	44
3.8 Total hours per semester	100
3.9 Number of credits	4

4. 4. Preconditions (where applicable)

4.1 of curriculum	-
4.2 of competences	-

5. Conditions (where applicable)

5.1 of conducting the course	Classroom equipped with a laptop, interactive whiteboard, appropriate software
5.2 of conducting the seminar and laboratory	Laboratory room properly equipped: computers, network, Internet connection, specialized software / online.

6. Specific Competencies Acquired

Professional Competencies	• C4 – Analyzes production processes to identify and implement improvements
Transversal Competencies:	• CT1 – Works in team

7. Learning outcomes

Knowledge	The student / graduate: - Defines performance indicators. - Knows effective communication and collaboration methods.
Skills	The student / graduate: - Identifies losses and nonconformities in the production process based on performance indicators - Demonstrates the ability to negotiate and resolve conflicts constructively.
Responsibilities and autonomy	The student / graduate: - Evaluates and optimizes the performance of the designed system, taking responsibility for the choice of technical solutions. - Takes responsibility for personal tasks and meets deadlines within a team.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	Development of the skills necessary for modeling, analyzing, designing, and implementing automation systems for complex industrial processes, with an emphasis on the use of modern control methods, hardware–software system integration, and optimization of process operation under safe, efficient, and robust conditions.
8.2 Specific objectives	Students are able to understand complex processes, process modeling, analysis and synthesis of control systems, designing and implementing automation solutions, simulation and validation, integration and monitoring of automated processes.

9. Course Content

9.1 Course	Teaching methods	Observations
1. Introduction to Complex Processes and Automation Architectures	Presentation, description, explanations, examples, dialogue, interaction	4 hours

2. Mathematical Modeling of Complex Processes	Presentation, description, explanations, examples, dialogue, interaction	4 hours
3. Analysis and Characterization of Complex Processes	Presentation, description, explanations, examples, dialogue, interaction	4 hours
4. Modern Control Methods for Complex Processes	Presentation, description, explanations, examples, dialogue, interaction	4 hours
5. Model-Based Predictive Control (MPC)	Presentation, description, explanations, examples, dialogue, interaction	4 hours
6. Advanced Acquisition, Supervision, and Monitoring Systems	Presentation, description, explanations, examples, dialogue, interaction	4 hours
7. Implementation of Automation Solutions for Complex Processes	Presentation, description, explanations, examples, dialogue, interaction	4 hours
	TOTAL	28 hours
Course bibliography: **1.** Daniel Dragu, *Automation of Complex Processes– Course and Laboratory Notes*, electronic version, 2025. **2.** Nicoleta-Alina Udroiu, *Elements of Electrical Engineering*, Ex Terra Aurum, Bucharest, 2021		

9.2 Laboratory	**Teaching methods**	**Observations**
1. Modeling of Complex Processes in Matlab/Simulink	Practical examples on computer. Design, implementation, testing	4 hours
2. Analysis of Multivariable (MIMO) Systems	Practical examples on computer. Design, implementation, testing	4 hours
3. Classical Control for Complex Processes	Practical examples on computer. Design, implementation, testing	4 hours
4. Robust and Adaptive Control	Practical examples on computer. Design, implementation, testing	4 hours
5. Model-Based Predictive Control (MPC)	Practical examples on computer. Design, implementation, testing	4 hours
6. PLC Implementation for Controlling a Complex Process	Practical examples on computer. Design, implementation, testing	4 hours
7. SCADA, Monitoring, and Advanced Diagnostics	Practical examples on computer. Design, implementation, testing	4 hours
	TOTAL	28 hours
Laboratory bibliography: 1. Daniel Dragu, *Automation of Complex Processes– Course and Laboratory Notes*, electronic version, 2025. 2. Nicoleta-Alina Udroiu, *Elements of Electrical Engineering*, Ex Terra Aurum, Bucharest, 2021		

10. Corroboration/validation of the course content with the expectations of representatives of the epistemic community, professional associations, and representative employers in the field related to the program

The course content is aligned with the syllabi of similar courses at other universities, both nationally and internationally. To better adapt the course content to labor market requirements, meetings were held with representatives from the business environment, and similar study programs from other universities were reviewed and analyzed. The teaching materials were developed based on representative textbooks in the field, recognized and appreciated by the academic community. Some of the examples presented during laboratory applications are derived from communications, lectures, project assignments, and other similar materials.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Knowledge and understanding of theoretical concepts, ability to apply	Written assignment / Multiple-choice test	50%
11.2 Laboratory	- Correct and efficient application of concepts in problem-solving - Active participation	Practical activities / Laboratory work	40% + 10%
11.3 Minimum performance standard			
- The student demonstrates knowledge of the main concepts, provides accurate definitions, and is capable of developing a basic application. - The student correctly uses the relevant technical terminology, even if in a simplified form. - The student achieves a minimum passing grade of 5 in laboratory assessments. - The student successfully completes a minimum required number of tasks, including theoretical questions and practical exercises.			

Date of completion	Signature of the course holder	Signature of the seminar/laboratory instructor
20.09.2025	Senior Lecturer dr.eng. Daniel Dragu	Senior Lecturer dr.eng. Daniel Dragu

Date of approval in the department	Signature of the department director
25.09.2025	Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council	Approval from the Dean
29.09.2026	Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

6. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	FACULTY OF ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Study Cycle	BACHELOR OF SCIENCE
1.6. Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

7. Course Information

2.1 Course Title:	ARTIFICIAL INTELLIGENCE TECHNIQUES
2.2 Course Lecturer:	Senior Lecture dr.eng. Daniel DRAGU
2.3 Seminar/Laboratory Instructor:	Assistant Professor Bogdana Tania GAVRILĂ
2.4 Year of Study:	4
2.5 Semester	2
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DS-compulsory

8. Total estimated time

3.1. Hours per week	3	of which 3.2 lecture	1	3.3 Project	2
3.4. Total hours in the study plan	42	of which 3.5 lecture	14	3.6 Project	28

Time allocation:	Hours
Study based on course materials, bibliography	10
Additional documentation in library, specialized databases, or field work	5
Preparation for seminars/labs, essays, portfolios	8
Tutoring	5
Examinations	2
Other activities...	3
3.7 Total hours of individual study	33
3.8 Total hours per semester	75
3.9 Number of credits	3

9. Preconditions (where applicable)

4.1. of curriculum	-
4.2. of competences	-

10. Conditions (where applicable)

5.1. of conducting the course	Classroom equipped with laptop, video projector / smart board and appropriate local/online software.

5.2 of conducting the project	Properly equipped laboratory room: computers, network, Internet connection, specialized / online software.

11. Specific competencies acquired

Professional competencies	• C5 – Design control systems • C9 – Develop Open Source Software
Transversal competencies	• CT2 – Comply with regulations • CT3 – Think Analytically

7. Learning Outcomes

Knowledge	• Understand the basic and advanced principles of automatic control (feedback, stability, tuning) and their application in the design of automated systems. • Identify open-source platforms and libraries for the development of technical software applications • Know the principles of professional ethics and deontology • Is familiar with the applicable procedures and quality standards • Processes information, ideas and concepts • Solve problems
Skills	• Design automatic control structures for industrial processes using mathematical models and performance criteria. • It uses open-source platforms and libraries for the development of technical software applications. • Correctly apply business-specific regulations, procedures, and instructions • Think creatively
Responsibilities and autonomy	• Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. • It has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). • Respects the principles of professional ethics in all activities carried out. • Approach issues critically

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	Familiarizing students with the fundamental concepts of artificial intelligence (AI) and training the skills necessary for the development, implementation and evaluation of solutions based on AI techniques for their application in the field of automation and applied informatics.
8.2 Specific objectives	Understanding the fundamental concepts of AI. Development of programming skills in languages and with libraries relevant to AI. Application of AI algorithms in practice. Evaluation of the performance of AI-based systems.

9. Contents

9.1 Course	**Teaching methods**	**Observations**
1. Introduction to AI: - - definitions, algorithms, the role of AI in automation and engineering;	Exposition, description, explanations, examples, dialogue, interaction	2 hours
2. Representation of knowledge - Rules, logic;		2 hours
3. Machine Learning: - supervised, unsupervised learning; - ML process: data collection, training, validation, testing; - classical models: regression, k-Nearest Neighbors, Support Vector Machine, decision trees;		2 hours
4. Artificial neural networks: - artificial neuron; - backpropagation; - feedforward and multilayer perceptron networks; - applications in classification and regression;		2 hours
5. Deep Learning - convolutional networks (CNN); - recurring networks; - software libraries: TensorFlow / PyTorch;		2 hours
6. Intelligent Systems and Evolutionary Optimization - genetic algorithms and metaheuristics; - population-based optimization;		2 hours
7. Ethics and responsibility		2 hours
	TOTAL	14 hours
Course bibliography: 1. D. Dragu, Artificial Intelligence Techniques – Course and Project Notes, electronic version, 2025. 2. C. Florea, L. Florea, Artificial Intelligence, "Transilvania" University of Brașov Publishing House, 2023, ISBN 978-606-19-1653-5.		

9.2 Project	**Teaching methods**	**Observations**
Applications with the main software libraries intended for AI: ML.NET, TensorFlow, PyTorch, etc.	Design, implementation, testing	28 hours
Project bibliography: 1. D. Dragu, Artificial Intelligence Techniques – Course and Project Notes, electronic version, 2025. 2. C. Florea, L. Florea, Artificial Intelligence, "Transilvania" University of Brașov Publishing House, 2023, ISBN 978-606-19-1653-5. 3. ML.NET Documentation https://learn.microsoft.com/en-us/dotnet/machine-learning/.		

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the course is in accordance with the course sheets from other universities in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held with representatives of the business environment and similar study programs from other universities were accessed and analyzed.

The teaching material was developed on the basis of representative textbooks of the field, recognized and appreciated by the academic community.

Some of the examples presented in the laboratory applications course originate from communications, lectures, project topics and other similar materials.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Knowledge and understanding of theoretical concepts, ability to apply	Written Paper / Grid Test	50%
11.2 Project	Correct and effective application of concepts in problem solving Active participation	Presentation	40% + 10%
11.3 Minimum Performance Standard 1. The student knows the main concepts, defines them correctly and builds a simple application; 2. The specialized language is simple, but correctly used; 3. Minimum grade 5 for the project; 4. To solve a minimum of topics well – questions and applications.			

Date of completion 20.09.2025

Signature of the course holder Senior lecturer.dr.eng. Daniel Dragu

Signature of the project instructor Assist.univ.drd. Bogdana Tania Gavrilă

Date of approval in the department 26.09.2025

Signature of the department director Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council 29.09.2026

Approval from the Dean Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

12. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	FACULTY OF ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Study Cycle	BACHELOR OF SCIENCE
1.6. Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

13. Course Information

2.1. Name of the discipline	PARALLEL AND DISTRIBUTED PROCESSING
2.2. Course activity holder	Senior Lecturer dr.eng. Daniel DRAGU
2.3.Owner of the laboratory activity	Senior Lecturer dr.eng. Daniel DRAGU
2.4.Year of study	4
2.5.Semester	1
2.6.Type of assessment	VERIFICATION
2.7.Discipline regime	DS-Optional

14. Estimated Total Time (hours per semester of didactic activities)

3.1. Hours per week	4	lecture	2	laboratory	2
3.4. Total hours in the study plan	56	lecture	28	laboratory	28
Time allocation:					Hours
Study based on course materials, bibliography					10
Additional documentation in library, specialized databases, or field work					10
Preparation for seminars/labs, essays, portfolios					10
Tutoring					5
Examinations					5
Other activities...					4
3.7 Total hours of individual study					44
3.8 Total hours per semester					100
3.9 Number of credits					4

15. Preconditions (where applicable)

4.1. of curriculum	-
4.2. of competences	-

16. Conditions (where applicable)

5.1. of conducting the course	Classroom equipped with laptop, smart board (if applicable) and appropriate software.

5.2. of conducting the laboratory	Properly equipped laboratory room: computers, network, Internet connection, specialized software.

17. Specific competencies acquired

Professional competencies	• C6 – Establish data processes
Transversal competencies	• CT1 – Work in teams

18. Learning Outcomes

Knowledge	• Understanding algorithms and data structures, programming paradigms and languages used in the field of automation • Know ways to communicate and collaborate effectively
Skills	• Use programming languages and ICT tools to transform raw data into useful information. • Demonstrates the ability to negotiate and resolve conflicts constructively
Responsibilities and autonomy	• Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. • Assumes their own tasks and respects the deadlines set in the team

19. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1. General objective of the discipline	Familiarity with the concepts, techniques and architectures essential for the design, implementation and management of parallel and distributed processing systems, as well as the development of practical skills in optimizing the performance and scalability of applications.
8.2.Specific objectives	• Know the basic principles and concepts of parallel and distributed processing. • To be able to develop applications using the concepts studied.

20. Content

9.1 Course	**Teaching methods**	Observations
1. Parallel systems, distributed systems	Exposition, description, explanations, examples, dialogue, interaction	2 hours
2. Data transfer languages		2 hours
3. Communication in SD with direct applications on the Internet.		2 hours
4. Web Services. SOAP, REST		4 hours
5. Parallelism. Competition		4 hours
6. Design of SD applications.		2 hours
7. Message-based communication. Encoding-Decoding.		4 hours

8. Overall design of an SD.		4 hours
9. Creation of server-type applications.		4 hours
	TOTAL	28 hours

Course Bibliography:

1. Dragu Daniel, Parallel and Distributed Processing - Course and Lab Notes, Electronic Version, 2025.
2. Tanenbaum, Andrew S., and Maarten Van Steen. Distributed systems: principles and paradigms. Prentice-Hall, 2007.
3. Alexander, Michael, Gardner William - Process algebra for parallel and distributed processing. CRC Press, 2009.
4. T. Cormen, C. Leiserson, R. Rivest, C. Stein, Introduction to Algorithms, MIT Press, 2009.
5. S. Nakov, V. Kolev & Co, Fundamentals of Computer Programming with C#, 2013, ISBN 978-954-400-773-7.

9.2 Laboratory work	**Teaching methods**	Observations
1. Examples of distributed automated systems	Exemplification on the computer. Functionality testing	2 hours
2. Examples of regulation in distributed automation systems		2 hours
3. Using the Visual Studio (C#) Programming Environment in the Study of Distributed Systems		2 hours
4. Application of the concepts learned for the development of a program for the management of telephone subscribers		2 hours
5. Creating a program for working with files and folders		2 hours
6. Using the ArrayList class to manage a student list		2 hours
7. Use threads to run ProgressBar controls		2 hours
8. Thread synchronization		2 hours
9. Application of Execution Threads in the Issue of Freight Transport		2 hours
10. Files distributed in a distributed storage system. RemoteHDD Problem		2 hours
11. - 14. Files distributed in a distributed storage system. Centralization on the server. Transfer inside the system. Automatic search and copying. Automatic back-up.		8 hours
	TOTAL	28 hours

Laboratory Bibliography:

1. Dragu, Daniel, Parallel and Distributed Processing - Lecture and Lab Notes, Electronic Version, 2025.
2. Tanenbaum, Andrew S., and Maarten Van Steen. Distributed systems: principles and paradigms. Prentice-Hall, 2007.
3. Alexander, Michael, Gardner William - Process algebra for parallel and distributed processing. CRC Press, 2009.

4. S. Nakov, V. Kolev & Co, Fundamentals of Computer Programming with C#, 2013, ISBN 978-954-400-773-7.
5. C# Programming Guide, https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/.

21. Corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in accordance with the discipline sheets of the discipline from other universities in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held with both representatives of the business environment and other specialized professors.

The teaching material was developed on the basis of representative textbooks of the field, recognized and appreciated by the academic community.

The examples presented in the course and laboratory applications aim to familiarize students with the customs of the field.

22. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Knowledge and understanding of theoretical concepts, ability to apply	Written Paper / Grid Test	50%
11.2 Laboratory	Correct and effective application of concepts in problem solving Active participation	Applicative activities / practical works	40% + 10%
11.3 Minimum Performance Standard 1. The student knows the main concepts, defines them correctly and builds a simple application; 2. The specialized language is simple, but correctly used; 3. Minimum grade of 5 in the laboratory; 4. To solve a minimum of topics well – questions and applications.			

Date of completion	Signature of the course holder	Signature of the laboratory instructor
20.09.2025	Senior lecturer.dr.eng. Daniel Dragu	Senior lecturer.dr.eng. Daniel Dragu

Date of approval in the department	Signature of the department director
26.09.2025	Assoc. Prof. dr. ing. Valentin Dan Muller

Date of approval in the faculty council	Approval from the Dean
29.09.2026	Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

23. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORT
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Cycle of studies	BACHELOR OF SCIENCE
1.6. Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

24. Course Information

2.1. Name of the discipline	DIPLOMA PROJECT DEVELOPMENT
2.2. Course activity holder	
2.3. Project activity holder	
2.4. Year of study	4
2.5. Semester	1
2.6. Type of assessment	VERIFICATION
2.7. Discipline regime	DS-compulsory

25. Total estimated time

3.1.Number of hours per week	1	of which 3.2 course	0	3.3 Project	4
3.4.Total hours in the curriculum	56	of which 3.5 courses	0	3.6 Project	56
Time Pool Distribution					Hours
Study by textbook, course material, bibliography and notes					25
Additional documentation in the library, on specialized electronic platforms and in the field					10
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					5
Tutorials					2
Examination					2
Other activities					-
3.7.Total hours of individual study					**44**
3.9.Total hours per semester					**100**
3.10.Number of appropriations					**4**

26. Preconditions (where applicable)

4.1.de curriculum	
4.2.de competences	

27. Conditions (where applicable)

5.1.de course	
5.2.de seminar/laboratory	Attendance is mandatory.

6. Specific competencies acquired

Professional competencies	- C5. Design control systems. - C6. Establish data processes. - C7. Perform laboratory tests.
Transversal competencies	- CT1 - Work in teams. - CT3 - Work in teams - Think analytically.

7. Learning Outcomes

Knowledge	The student/graduate: -Understand the basic and advanced principles of automatic control (feedback, stability, tuning) and their application in the design of automatic systems. -Know the structure, operation and interaction of hardware and software components in an industrial control system (sensors, ---- Know algorithms for data processing and analysis. -Knows programming languages (e.g. C++, C#) -Understanding of algorithms and data structures, programming paradigms and languages used in the field of automation (actuators, controllers, interfaces) - Knows and knows how to use specific laboratory equipment. - Has knowledge of data analysis and interpretation. - Knows the principles and stages of teamwork Know ways to communicate and collaborate effectively -Processes information, ideas and concepts -Solve problems - Think creatively and innovatively
Skills	The student/graduate: -Design automatic control structures for industrial processes using mathematical models and performance criteria. -Integrates and configures hardware components (PLCs, microcontrollers, industrial communication networks) and software into a functional automatic control/control system. -Create algorithms for data processing and analysis in industrial and engineering applications. -Use programming languages (e.g. Python, R) and ICT tools to transform raw data into useful information. -Plans and executes engineering experiments using specific laboratory equipment. -Analyzes and interprets experimental data to validate hypotheses or technical performances. -Actively participates in team activities, contributing to the achievement of common goals. -Demonstrates the ability to negotiate and resolve conflicts constructively. -Think analytically -Think critically -Think creatively

Responsibilities and autonomy	The student/graduate: -Evaluates and optimizes the performance of the designed system, assuming responsibility for choosing technical solutions. -Can work independently or in a team to implement and test automation solutions in a real professional environment. -Has the ability to manage technical projects responsibly and on time. -Has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). -Assumes his/her own tasks and respects the deadlines set in the team -Contributes to a positive and productive climate in the team. -Approaches issues critically -Analyzes experimental laboratory data Develop new installations.

8. Objectives of the discipline (resulting from the grid of specific competences acquired)

8.1 General objective of the discipline	- practical application of previously acquired knowledge - working in research and development
8.2 Specific objectives	- developing practical skills, - development of research capacity

10. Content

9.1 Course	Teaching methods	Observations
9.2 Laboratory	Teaching methods	Observations
Research and development activities	Supervision and guidance by the diploma advisor.	

11. Corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline, together with the skills and abilities acquired, correspond to the expectations of the professional organizations in the field, the companies in the field where the students carry out their internship activities and/or occupy a job, as well as the national and international quality assurance bodies (ARACIS). It also ensures the adoption of ethical standards appropriate to engineering practice.

12. Assessment

Completion date	Holders	Title, Name, Surname	Signature
	Course		
	Applications		

Date of completion
20.09.2025

Signature of the department director

Assoc.prof.eng. Valentin Dan Muller

Date of approval in the department

26.09.2025

Dean Signature

Senior lecture eng. Corina-Anca Mnerie

Date of approval in the faculty council
29.09.2026

Approval from the Dean
Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	FACULTY OF ENGINEERING
1.3 Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title:	MECHATRONICS
2.2 Course Lecturer:	Senior Lecturer dr.eng. Adriana Elena MICŞA
2.3 Laboratory Instructor:	Senior Lecturer dr.eng. Adriana Elena MICŞA
2.4 Year of Study:	4
2.5 Semester	1
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DS-compulsory

3. Estimated Total Time (hours per semester of didactic activities)

3.1 Hours per week	3	of which 3.2 lecture	2	3.3 Laboratory	1
3.4 Total hours in the study plan	42	of which 3.5 lecture	28	3.6 Laboratory	14

Time allocation:	Hours
Study based on course materials, bibliography	10
Additional documentation in library, specialized databases, or field work	5
Preparation for seminars/labs, essays, portfolios	10
Tutoring	5
Examinations	2
Other activities...	1
3.7 Total hours of individual study	33
3.8 Total hours per semester	75
3.9 Number of credits	3

4. Preconditions (where applicable)

4.1 of curriculum	Programming and using the computer
4.2 of competences	Identifying, defining, using notions in the field of engineering sciences; Use of graphic principles and tools for describing and presenting elements in the engineering field.

5. Conditions (where applicable)

5.1 of conducting the course	Classroom equipped with smart board, laptop, video projector, appropriate software

5.2 of conducting the laboratory	Seminar/laboratory room equipped with the appropriate technology for the discipline (laptop, myRIO acquisition board, corresponding software)

6. Specific competencies acquired

Professional competencies	C2. Design electronic systems - Sketch and design electronic systems, products and components, using computer aided design (CAD) software and equipment. Perform a simulation so that an assessment of the viability of the product can be carried out and that the physical parameters can be examined before the actual construction of the product. C3. Include new products in the production process – Help integrate new systems, products, methods, and components into the production line. It ensures that production workers are properly trained and comply with new requirements.
Transversal competencies	CT3. Think analytically – Think using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.

7. Learning Outcomes

Knowledge	Graduate: He has knowledge of electronic schematics and methods of designing electronic systems. He has knowledge in simulation programs. He has knowledge of the operation of some methods, algorithms, equipment. Identify how certain products can be included in production.
Skills	Make electronic schematics and printed circuit boards using specialized software. It performs measurementsto verifythe functionality and viability of systems designed before manufacturing. Document and implement procedures for introducing a new product into the manufacturing flow. It ensures the training of operators and the adaptation of equipment to the requirements of the new product.
Responsibilities and autonomy	Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. Can work independently or in a team to implement and test automation solutions in a real professional environment. Has the ability to manage technical projects responsibly and on time. It has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control).

	Manifestation of ethical behavior and a professional attitude in the engineering activity.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	Development of generic theoretical and practical skills in engineering sciences. Ensuring the engineering knowledge fund specific to the field of systems engineering; Developing skills and abilities for researching, developing, designing and implementing specific processes, products and services. Development of skills and abilities in the use of computing technology and computer tools in engineering activities; Development of the knowledge necessary for technical-economic analyses. Development of strategic partnerships with the business environment to facilitate the access and insertion of graduates on the local, national and European labor market. The graduates of the "Automation and Applied Informatics" study program have the ability to integrate into multidisciplinary processes and product development teams, being qualified as specialists with very well-defined skills in order to create, through computerized methods, the technical documentation specific to industrial fields.
8.2 Specific objectives	Fundamental engineering training. Ensure knowledge of computer graphics and computer-aided graphic design skills. Provide general technical knowledge in the field of systems engineering. Development of skills in the use of specific industrial technologies. Ability to conceive, promote and carry out group projects; Acquire the skills to integrate technical knowledge specific to all categories of processes and products. Acquiring the ability to direct the quality of products at the design stage, to control and verify the final quality of products and processes.

9. Contents

9.1 Course	**Teaching methods**	**Observations**
The concept of "mechatronics"	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Modeling of mechatronic systems	Participatory lecture, debate, exposition, problematization,	2 hours

	demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	
Analogies between mechanical and electrical systems	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Generalized sizes for mechatronic system components	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Engine assembly – drive mechanism – load	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Drive systems	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Stepper Motor (MPP) Considerations	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Unconventional drives	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Sensors	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Proximity sensors	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment,	2 hours

	bibliographic study, challenge by questions	
Analog position and displacement sensors	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Digital position and displacement sensors	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
Sensors for Forces and Moments	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study by discovery, by experiment, bibliographic study, challenge by questions	2 hours
	Total	28 hours
Course bibliography	[1] ALTMANN, Wolfgang. - Practical process control for engineers and technicians. Wolfgang Altmann, David Macdonald. Amsterdam: Elsevier, 2008. 290 p.: fig., tab.; 26 cm. (Manufacturing / Engineering). Appendix p. 176-285. ISBN 978-0-7506-6400-4. Id. at 21170; 681/A44. [2] Vistrian Măţieş, Olimpiu Tătar, Mihai Măţieş, Vencel Csibi - Actuators in mechatronics. Cluj-Napoca: Mediamira, 2000. 312 p.: il., fig., tab.; 24 cm. Bibliogr. pp. 289-302. ISBN973-9358-16-0. III 15383; 681/A16. [3] Titus Cioare - considerations regarding sensors and signal processing systems, notes 2006. [4] Subsidiesof mechatronic systems, course notes, Micșa Adriana, SUMS platform, 2025. [5] https://learn.ni.com/teach/resources/965/fundamentals-of-mechatronic-sensors, 2018. [6] Mechatronics Fair 2018 – exhibitors, technology projects and much more. [7] https://mdm.utcluj.ro/old/Proiecte/Smanar/rezultate.html - mechatronic drive systems made with new types of actuators for applications in robotics and other fields.	

9.2 Laboratory	**Teaching methods**	**Observations**
Modeling of mechatronic systems	Conversation, Debate, Cooperative learning, Teamwork	4 hours

Generalized sizes for mechatronic system components	Conversation, Debate, Cooperative learning, Teamwork	1 hour
Laboratories with the myRIO Board Mechatronics Laboratory Kit		
1. Servo motor	Conversation, Debate, Cooperative learning, Teamwork	2 hours
2. Adapter Motor and Gear Motor for NI myRIO Board	Conversation, Debate, Cooperative learning, Teamwork	1 hour
3. IR Range Finder (infrared proximity sensor)	Conversation, Debate, Cooperative learning, Teamwork	1 hour
4. Sonic Range Finder (Ultrasonic Proximity Sensor)	Conversation, Debate, Cooperative learning, Teamwork	1 hour
5. Accelerometer	Conversation, Debate, Cooperative learning, Teamwork	1 hour
6. Gyroscope	Conversation, Debate, Cooperative learning, Teamwork	1 hour
7. Compass	Conversation, Debate, Cooperative learning, Teamwork	1 hour
8. Ambient Light Sensor	Conversation, Debate, Cooperative learning, Teamwork	1 hour
	Total	14 hours
Laboratory bibliography	[1] Ni trend watch 2019 Trends and challenges in automated test and automated measurement. [2] http://kataloge.christiani.de/2020/AT-Broschuere_PS-F2020/ - Automatiesierung und Industrie 4.0. [3] http://kataloge.christiani.de//2020/Berufsschule-Broschuere/ - Fachbucher Mechatronik [4] User guide and specifications NI myRIO 1900, 2018 edition. [5] NImyRIO Project Essentials Guide, Ed Doering, Electrical and Computer Engineering Department Rose-Hulman Institute of Technology, Printed February 9, 2016. [6] Databaseof mechatronic systems, laboratory notes, Micșa Adriana, SUMS platform, 2025.	

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The university curriculum, for a study program, must be structured based on the proposals of the social partners of the higher education institution (especially research, design, construction, maintenance and operation companies), so that the graduate of the respective study program is easy to enter the labor market, immediately after completing the first cycle of studies (bachelor's degree), thus being stimulated to participate in master's and doctoral courses, organised in collaboration with the social partners.

In the case of the study program: "Automation and Applied Informatics" when drawing up the university curriculum, the standards in the field with immediate applicability must be taken into account, thus ensuring a compatibility of the curricula with the European ones as well as a better mobility of students through European programs (Socrates/Erasmus, Leonardo da Vinci, Tempus II, etc.).

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Students' ability to assimilate theoretical notions	Evaluation of theoretical notions during a topic carried out for evaluation within the chapter	25%
	Students' ability to practically analyze a mechatronic system based on the knowledge assimilated from the course corroborated with laboratory hours	System modeling Evaluation of theoretical notions during a topic carried out for evaluation within the chapter Acquisition and interpretation of the data obtained within the measurements specific to the individual theme	25%
11.2 Laboratory	Active participation of students in the practical exercises (similar to the course requirements) given in the analysis in order to deepen the knowledge stated in the course	Periodic evaluation during the semester	25%
	Students' ability to form and develop	Periodic evaluation during the semester	25%

	discipline-specific skills with the help of the specific laboratories of the mechatronics kit attached to the myRIO board or other profile boards - ARDUINO		
11.3 Minimum Performance Standard Elaboration of a synthesis work in the field using pre-established criteria.			

Date of completion Signature of the course holder Signature of the laboratory instructor
20.09.2025 Senior lecturer.dr.eng. Adriana Elena Micșa Senior lecturer.dr.eng. Adriana Elena Micșa

Date of approval in the department
26.09.2025

Signature of the department director
Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council
29.09.2026

Approval from the Dean
Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Data

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	FACULTY OF ENGINEERING
1.3 Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title:	BIOMEDICAL ENGINEERING
2.2 Course Lecturer:	Senior Lecturer dr.eng. Corina-Anca MNERIE
2.3 Seminar/Laboratory Instructor:	Senior Lecturer dr.eng. Corina-Anca MNERIE
2.4 Year of Study:	4
2.5 Semester	2
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DS-Optional

3. Estimated Total Time (hours per semester of didactic activities)

3.1 Hours per week	3	of which 3.2 lecture	2	3.3 Laboratory	1
3.4 Total hours in the study plan	42	of which 3.5 lecture	28	3.6 Laboratory	14

Time allocation:	Hours
Study based on course materials, bibliography	2
Additional documentation in library, specialized databases, or field work	3
Preparation for seminars/labs, essays, portfolios	2
Tutoring	
Examinations	
Other activities...	1
3.7 Total hours of individual study	8
3.8 Total hours per semester	50
3.9 Number of credits	2

4. Preconditions (where applicable)

4.1 of curriculum	
4.2 of competences	

5. Conditions (where applicable)

5.1 of conducting the course	Classroom, video projector/smartboard
5.2 of conducting the laboratory	Computers, Dedicated Software, Scanning System

6. Specific competencies acquired

Professional competencies	C3. Include new products in the production process.

Transversal competencies	CT2. Comply with regulations. CT3. Think analytically.

7. Learning Outcomes

Knowledge	He has knowledge of medical equipment used in imaging. Has knowledge of how the equipment works. Define equipment performance indicators. It processes information, ideas and concepts. Think creatively and innovatively.
Skills	Identify losses and non-conformities in the production process based on performance indicators. Documents and implements procedures for introducing a new product into the manufacturing flow. It ensures the training of operators and the adaptation of equipment to the requirements of the new product. It provides support to users of biomedical equipment. Conduct experiments in the laboratory. Think analytically. Think critically. Think creatively.
Responsibilities and autonomy	Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. Can work independently or in a team to implement and test automation solutions in a real professional environment. Has the ability to manage technical projects responsibly and on time. It analyzes experimental laboratory data. Develop new installations.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	The discipline of Biomedical Engineering aims to train students in the sense of general knowledge of the field of medical measurements, of the electrical manifestations of living matter, of the necessary biological parameters, of their retrieval and processing, of the systems specific to this field, of the special processing specific to this field, of the equipment and devices intended for the field of medicine, as well as of the development of the cognitive basis necessary for an engineering vision and development technical conception and design capacity.
8.2 Specific objectives	Forming a systems thinking in the field of biomedical engineering as well as learning the means for substantiating, organizing and conducting experiments Knowledge of the specific parameters of different categories of devices used in medicine;

9. Contents

9.1 Course	Teaching methods	Observations
1. Introduction. Areas of application. Connection with the field of Systems Engineering.	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
2. Medical Imaging - X-ray radiation - Computer Tomograph - MRI (MRI) - PET CT - Ultrasound - Microscopy	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	6 hours
3. Scanning systems with applications in Biomedical Engineering. OCT scanning systems	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	4 hours
4. Electrodes	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
5. Biopotential enhancers.	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	4 hours
6. Electroencephalography. Introduction. Signal acquisition. Modeling	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	3 hours
7. Electrocardiography. Introduction. Signal acquisition. Modeling	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	3 hours
8. Regulation systems applied in medicine.	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	4 hours
	Total	28 hours

Course bibliography:

1. Joseph D. Bronzino, Editor, The Biomedical Engineering Handbook, Third Edition, Medical Devices and Systems, 2006, CRC Press.
2. Mnerie Corina – Laboratory Advisor 2025, electronic format.
3. Michael Bass, Ed., Handbook of optics, 3rd edition (McGraw-Hill, New York, 2010).
4. Corina Mnerie, Stefan Preitl, and Virgil-Florin Duma, Galvanometer-Based Scanners: Mathematical. 5. Model and Alternative Control Structures for Improved Dynamics and Immunity to Disturbances, International Journal of Structural Stability and Dynamics, 1740006 (2017).
6. P. Naga Srinivasu, T. Srinivasa Rao, A.M. Dicu, C.A. Mnerie, I. Olariu, A comparative review of optimization techniques in segmentation of brain MR images, Journal of Intelligent & Fuzzy Systems.
7. S. Coroban, C. Mnerie, V.-F. Duma*, OCT versus X-ray imaging in the inspection of Ball Grid Arrays (BGAs), Proc. SPIE, Vol. 12618, 1261825, Optical Measurement Systems for Industrial Inspection XIII (SPIE Optical Metrology – LASER Congress), Munich, 2023.
8. R. Beiu, V.-F. Duma*, C. Mnerie, A.-C. Beiu, M. Dochia, L. Copolovici, G. Dobre, A. Bradu, A. Podoleanu, Optical coherence tomography versus microscopy for the study of Aloe Vera leaves, Proc. SPIE, Vol. 12138, 121380A, P. Schelkens, T. Kozacki, Eds., SPIE Photonics Europe (Optics, Photonics and Digital Technologies for Imaging Applications VII), Strasbourg (France), Apr. 3-7, 2022.

9.2 Laboratory	**Teaching methods**	**Observations**
1D galvanometric scanner for biomedical imaging: optimized driving	Simulation vs real lab testing	4 hours
Optical Coherence Tomography (OCT).	Presentation of the system in the laboratory	2 hours
Optical Coherence Tomography (OCT).	Test preparation. Measurements.	2 hours
Processing of images acquired with the OCT system		2 hours
Regulation systems applied in medicine. matlab Applications	Simulation in Matlab	4 hours
	Total	14 hours

Laboratory bibliography

1. Joseph D. Bronzino, Editor, The Biomedical Engineering Handbook, Third Edition, Medical Devices and Systems, 2006, CRC Press.
2. Mnerie C – course notes 2025, electronic format.
3. Michael Bass, Ed., Handbook of optics, 3rd edition (McGraw-Hill, New York, 2010).
4. Corina Mnerie, Stefan Preitl, and Virgil-Florin Duma, Galvanometer-Based Scanners: Mathematical. 5. Model and Alternative Control Structures for Improved Dynamics and Immunity to Disturbances, International Journal of Structural Stability and Dynamics, 1740006 (2017).
6. P. Naga Srinivasu, T. Srinivasa Rao, A.M. Dicu, C.A. Mnerie, I. Olariu, A comparative review of optimization techniques in segmentation of brain MR images, Journal of Intelligent & Fuzzy Systems.

7. S. Coroban, C. Mnerie, V.-F. Duma*, OCT versus X-ray imaging in the inspection of Ball Grid Arrays (BGAs), Proc. SPIE, Vol. 12618, 1261825, Optical Measurement Systems for Industrial Inspection XIII (SPIE Optical Metrology – LASER Congress), Munich, 2023.

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in accordance with what is done in other university centers in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held with representatives of the business environment, employers and university education teachers.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	Knowledge of the main methods of investigation through imaging and acquisition of biosignals;	Written Assessment	50%
11.2 Seminar/Workshop	- understanding and ability to apply the methods learned - interest in individual study - compliance with deadlines	Laboratory activity Making and delivering a presentation for one of the topics studied in progress	25% 25%
11.3 Minimum Performance Standard The condition for awarding a grade of 5 is the conclusion of the situation at the laboratory and the resolution of the exam topics in a proportion of at least 50%.			

Date of completion 20.09.2025 | Signature of the course holder Senior lecturer.dr.eng. Corina-Anca Mnerie | Signature of the laboratory instructor Senior lecturer.dr.eng. Corina-Anca Mnerie

Date of approval in the department 26.09.2025 | Signature of the department director Conf.dr.ing. Valentin Dan Muller

Date of approval in the faculty council 29.09.2026 | Approval from the Dean Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	FACULTY OF ENGINEERING
1.3 Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Course Title:	RELIABILITY AND DIAGNOSTICS
2.2 Course Lecturer:	Senior Lecturer dr.eng. Corina Anca MNERIE
2.3 Seminar/Laboratory Instructor:	Senior Lecturer dr.eng. Corina Anca MNERIE
2.4 Year of Study:	4
2.5 Semester	2
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DS-compulsory

3. Estimated Total Time (hours per semester of didactic activities)

3.1 Hours per week	2	of which 3.2 lecture	1	3.3 Laboratory	1
3.4 Total hours in the study plan	28	of which 3.5 lecture	14	3.6 Laboratory	14
Time allocation:					Hours
Study based on course materials, bibliography					6
Additional documentation in library, specialized databases, or field work					6
Preparation for seminars/labs, essays, portfolios					6
Tutoring					2
Examinations					2
Other activities...					
3.7 Total hours of individual study					22
3.8 Total hours per semester					50
3.9 Number of credits					2

4. Preconditions (where applicable)

4.1 of curriculum	
4.2 of competences	

5. Conditions (where applicable)

5.1 of conducting the course	Classroom, video projector/smartboard.
5.2 of conducting the laboratory	Computers, dedicated software, Interactive whiteboard.

6. Specific competencies acquired

Professional competencies	C1. Perform analytical mathematical calculations C3. Include new products in the production process C4. Analyze production processes for improvement C7. Perform laboratory tests
Transversal competencies	CT3. Analytical thinking

7. Learning Outcomes

Knowledge	Has knowledge of system reliability and diagnostics. Define performance indicators. Knows and identifies mathematical methods (linear algebra, numerical analysis) for modeling and solving engineering problems. It uses specific software tools (e.g. MATLAB) to automate analytical calculations and verify mathematical solutions in real contexts. Knows and knows how to use specific laboratory equipment. Has knowledge of data analysis and interpretation.
Skills	Identify losses and non-conformities in the production process based on performance indicators. Documents and implements procedures for introducing a new product into the manufacturing flow. Solves problems for analyzing and calculating system reliability. Think analytically and creatively.
Responsibilities and autonomy	Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. Can work independently or in a team to implement and test automation solutions in a real professional environment. Has the ability to manage technical projects responsibly and on time. It analyzes experimental data, develops new projects.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1 General objective of the discipline	Knowledge of the approach to quality and reliability assurance as essential features of any production process or product. Performing the statistical analysis of a production process or product, determining its reliability and hazard rate (failure frequency), designing complex systems to ensure the reliability required in operation, analyzing the factors influencing quality and reliability, respectively choosing the optimal maintenance strategy for a certain product.
8.3 Specific objectives	Formation of analytical thinking in terms of quality control and synthetic thinking in terms of optimal design of processes in terms of quality assurance of products (and services). Understanding the notions of reliability and hazard rate.

	Correct interpretation of the experimental results regarding a manufactured product or its production process. Understanding the importance of quality control and proper design of a manufacturing process or service to ensure the quality required by the beneficiary.

9. Contents

9.1 Course	Teaching methods	Observations
1. Principles of quality Quality characteristics Statistical analysis of continuous performance characteristics Statistical control of the quality of products and services. Quality indicators	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
2. Notions of probability theory Events Composition of probabilities Binomial distribution	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
3. Principles of reliability Definitions. Repairable and non-repairable products. Hazard rate (instantaneous failure frequency). Typical forms of the variation of the hazard rate (valve curve)	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
4. Reliability of systems Series systems Parallel systems Mostly parallel systems Standby redundancy	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	4 hours
5. Hazard rate – data and models Factors on which the hazard rate depends Hazard Rate Examples – Components and Systems Representative models. The influence of the human factor	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
6. Reliability in maintenance Cost-Profit-Hazard Rate Curve Maintenance strategies	Participatory lecture, debate, exposition, problematization, demonstration, modeling, study through discovery, challenge through questions	2 hours
	Total	14 hours

Course bibliography:

1. R. D. Leitch, Reliability analysis for engineers, Oxford University Press, N.Y., 1995.
2. J. P. Bentley, Introduction to reliability and quality engineering, Addison-Wesley Longman (England), 2nd ed, 1999.

3. Rolf Isermann, Fault-Diagnosis Applications, Model-Based Condition Monitoring: Actuators, Drives, Machinery, Plants, Sensors, and Fault-tolerant Systems, Springer, 2011.
3. Corina Anca Mnerie – course notes, electronic format, 2025.

9.2 Laboratory	Teaching methods	Observations
Statistical control of the quality of products and services. Quality indicators	Troubleshooting	2 hours
Events Composition of probabilities Binomial distribution	Troubleshooting	2 hours
Repairable and non-repairable products. Hazard rate (instantaneous failure frequency)	Troubleshooting	4 hours
System reliability of complex systems	Problem solving. Proposal of problems in industrial activity. Visiting the quality department of a practice partner firm.	6 hours
	Total	14 hours

Laboratory bibliography:

1. R. D. Leitch, Reliability analysis for engineers, Oxford University Press, N.Y., 1995;
2. J. P. Bentley, Introduction to reliability and quality engineering, Addison-Wesley Longman (England), 2nd ed, 1999.
3. Hamid Bazargan_Harandi, Reability Engineering. Theoty and practice, 2023
4. Corina Anca Mnerie – laboratory notes, electronic format, 2025.

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in accordance with what is done in other university centers in the country and abroad. In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held with representatives of the business environment, employers and university education teachers.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	- correctness and completeness of knowledge; - logical coherence; - the degree of assimilation of the specialized language;	Written Assessment	50%

11.2 Laboratory	- understanding and ability to apply the methods learned - interest in individual study - compliance with deadlines	Laboratory activity Making and presenting homework	25% 25%
11.3 Minimum Performance Standard The condition for granting a grade of 5 is the teaching of homework and the resolution of the exam topics in a proportion of at least 50%.			

Date of completion Signature of the course holder Signature of the laboratory intructor
20.09.2025 Senior lecturer.dr.eng. Corina Anca Mnerie Senior lecturer.dr.eng. Corina Anca Mnerie

Date of approval in the department Signature of the department director
26.09.2025 Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council Approval from the Dean
29.09.2026 Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

28. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	FACULTY OF ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Study Cycle	BACHELOR OF SCIENCE
1.6. Study Program/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

29. Course Information

2.1 Course Title:	MODELING BIOLOGICAL SYSTEMS
2.2 Course Lecturer:	Senior Lecturer dr.eng. Corina-Anca MNERIE
2.3 Seminar/Laboratory Instructor:	Senior Lecturer dr.eng. Corina-Anca MNERIE
2.4 Year of Study:	4
2.5 Semester	2
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DC-optional

30. Estimated Total Time (hours per semester of didactic activities)

3.1. Hours per week	3	of which 3.2 lecture	2	3.3 Laboratory	1
3.4. Total hours in the study plan	42	of which 3.5 lecture	28	3.6 Laboratory	14
Time allocation:					Hours
Study based on course materials, bibliography					2
Additional documentation in library, specialized databases, or field work					2
Preparation for seminars/labs, essays, portfolios					2
Tutoring					
Examinations					2
Other activities...					
3.7 Total hours of individual study					8
3.8 Total hours per semester					50
3.9 Number of credits					2

31. Preconditions (where applicable)

4.1. of curriculum	Physics, Electrical Engineering, Linear Electronic Circuits, Measurements and Transducers, Analog and Digital Integrated Circuits, Computer Programming and Use, Computer Architecture, Artificial Intelligence.
4.2. of competences	The continuity of the applicative capitalization of the acquired knowledge allows a gradual passage through the chapters, in

	close relation with the theme of the previously studied disciplines.

32. Conditions (where applicable)

5.1. of conducting the course	Classroom, equipped with laptop, video projector and appropriate software.
5.2. of conducting the laboratory	Laboratory room, properly equipped: computers, network, Internet connection, specialized software.

33. Specific competencies acquired

Professional competencies	C5. Application development and implementation of automated driving algorithms and structures, using project management principles, programming environments and technologies based on microcontrollers, signal processors, programmable automatons, embedded systems
Transversal competencies	

7. Learning Outcomes

Knowledge	He has knowledge of medical equipment used in imaging. Has knowledge of how the equipment works. Define equipment performance indicators. It processes information, ideas and concepts. Think creatively and innovatively.
Skills	Identify losses and non-conformities in the production process based on performance indicators. Documents and implements procedures for introducing a new product into the manufacturing flow. It ensures the training of operators and the adaptation of equipment to the requirements of the new product. It provides support to users of biomedical equipment. Conduct experiments in the laboratory. Think analytically. Think critically. Think creatively.
Responsibilities and autonomy	Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. Can work independently or in a team to implement and test automation solutions in a real professional environment.

	Has the ability to manage technical projects responsibly and on time. It analyzes experimental laboratory data. Develop new installations.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1. General objective of the discipline	The discipline Modelling of Biological Processes aims at an introduction to the mathematical modelling of biological processes and lays the foundations for the further development of a career in this modern interdisciplinary field. The notions of model, biological system and process, mathematical modeling of biological processes are presented. Simple models (exponential, logistic) and their variants in population ecology and demography are described. The course also presents complex mathematical models for the evolution of biological populations, for the interaction between various populations, for the dynamics of infectious diseases, as well as for other biological processes and mechanisms. Within the laboratory activities, dedicated software methods and technologies for the analysis and modeling of various biological processes are presented. Basic knowledge of mathematics and programming in Matlab is required to complete the course. The course uses notions learned by students in the disciplines: mathematics, electrical engineering, physics, electronic devices and circuits, measurements and transducers, analog and digital integrated circuits, computer architecture, artificial intelligence. The practical works and the project carried out within the discipline aim to acquire practical experiments as well as the ability to simulate the functioning of certain systems specific to the biomedical field. The conclusions resulting from calculations, practical experiments and simulations form skills for students to prepare an engineering report. This subject imposes seriousness and discipline on students.
8.2.Specific objectives	**1. Knowledge and understanding** • knowledge of the field of modeling of biological processes, of the electrical manifestations of living matter, of the necessary biological parameters, of their retrieval and processing, of the electronic circuits and systems specific to this field, of the special processing specific to this field, of the specific equipment, as well as of the development of the cognitive basis necessary for an engineering vision and

	the development of the capacity of technical conception and design. • Formation of a systemic thinking in the field of modeling biological processes as well as the accustoming of the means for substantiating, organizing and conducting experiments. • Knowledge of the specific parameters of the different categories of fundamental heels used in medicine; • Realization of combinations of functional blocks for the implementation of complex systems. • Analyzing the performance indicators of biological models; • Proposing methods to improve performance, based on the analysis of parameters. **2. Explanation and interpretation** • Explanation and correct interpretation of experimental data obtained from various measurements, understanding the principles of operation of biological models. • Explanation of how different types of devices work as well as the optimal option to choose for certain types of applications. **3. Instrumental – applicative** • To provide the student with the ability to take measurements. • Performing a critical analysis of a studied system. • Handling and operation with common medical devices. • To provide the student with the knowledge and skills necessary to present a measurement system. • To teach the student how to save data, process and interpret them using specialized programs. • To be able to carry out experimental schemes either physically or using specialized programs. • Performing a critical analysis of a studied technical system. • To provide the student with the specific knowledge and skills for designing, implementing, testing and evaluating an application. • To provide the student with the knowledge and skills necessary to present a specific application. • To develop the skills of writing papers, scientific papers specific to the field and participation in conferences. **4. Attitudinal** • manifesting a positive and responsible attitude towards the field of modeling biological systems.

	• Manifesting a positive and responsible attitude towards the scientific field. • Optimal and creative capitalization of the potential of each student in scientific activities. • Awareness of engaging in partnership relationships with other people and getting used to teamwork. • Participation in one's own professional development.

9. Content

9.1 Course	**Teaching methods**	**Observations**
Introduction to Modeling Biological Processes	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
Dynamic models. Equations with differences	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
Linear models for structured populations	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	6 hours
Nonlinear patterns of interactions between populations	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	6 hours
Dynamics of infectious diseases. Case studies	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	8 hours
	Total	28 hours

Course bibliography:

1. Mnerie Corina-Anca, course material in electronic format, 2025.
2. Ana Pavel, C. Vasile, C. Buiu – Biomathematics and bioinformatics. Concepts and Applications, University Publishing House, Bucharest, 2011.
3. C. Buiu, A. Dumitrascu – Modeling of biological processes, Electra Press, Bucharest, 2004.

4. J.W. Haefner, Modeling Biological Systems: Principles and Applications, Springer, 2005.
5. E.S. Allman, J.R. Rhodes, Mathematical Models in Biology. An Introduction, Cambridge University Press, 2003.
6. M. Belis, Bioengineering of Adaptive and Instructible Systems, Scientific and Encyclopaedic Publishing House, Bucharest, 1981.
7. Dan Teodorescu, Biosystems Engineering, Facla Publishing House, 1978.
8. Dawn E. Holmes, Lakhmi C. Jain (Eds.), Data Mining: Foundations and Intelligent. Paradigms, Volume 3: Medical, Health, Social, Biological and other Applications, Springer, 2012.

Virtual teaching materials:

1. G TEC Medical Engineering – Brain Computing Interface, http://www.gtec.at/Download.
2. BIOPAC System Inc., http://www.biopac.com/Research.asp.
3. Steven W. Smith, The Scientist and Engineer's Guide to Digital Signal Prcessing http://www.dspguide.com/.
4. http://www.transparentcorp.com/products/np/index.php.
5. Ramaswamy Palaniappan, Biological Signal Analysis, 2010, Ramaswamy Palaniappan & Ventus Publishing ApS, http://www.fulviofrisone.com/attachments/article/415/introduction-to-biological-signal-analysis.pdf.
6. John L. Semmlow, Biomedical Image Processing, MATLAB-Based Applications, Marcel Dekker, Inc., 2004, http://cgrava.webhost.uoradea.ro/teaching/ImaMed/documentatie/Dekker_Biomedical_Image_Processing.pdf.
7. Riccardo de Asmundis, Modeling, Programming and Simulations Using LabVIEW™ Software, INTECH, 2011, http://www.intechopen.com/books/modeling-programming-and-simulations-using-labview-software.

9.2 Laboratory	**Teaching methods**	**Observations**
1. Systems Biology Markup Language SBML 2. Modeling of dynamic systems: exponential model, logistic model, applications. 3. Linear models for structured populations 4. Nonlinear patterns of interactions between populations: the prey-predator model, the Lotka-Volterra model 5. Dynamics of infectious diseases and epidemics: SIR, SEIR, SEIRS, SIS models; Applications 6. Rebounds	Computer modeling and simulation using the Matlab environment.	2 hours 2 hours 2 hours 2 hours 2 hours 2 hours 2 hours
	Total	14 hours

Bibliography laboratory:

1. Mnerie Corina-Anca, course material in electronic format, 2025.
2. Ana Pavel, C. Vasile, C. Buiu – Biomathematics and bioinformatics. Concepts and Applications, University Publishing House, Bucharest, 2011.
3. C. Buiu, A. Dumitrascu – Modeling of biological processes, Electra Press, Bucharest, 2004.
4. J.W. Haefner, Modeling Biological Systems: Principles and Applications, Springer, 2005.
5. E.S. Allman, J.R. Rhodes, Mathematical Models in Biology. An Introduction, Cambridge University Press, 2003.
5. M. Belis, Bioengineering of Adaptive and Instructible Systems, Scientific and Encyclopaedic Publishing House, Bucharest, 1981.
6. Dan Teodorescu, Biosystems Engineering, Facla Publishing House, 1978.
7. Dawn E. Holmes, Lakhmi C. Jain (Eds.), Data Mining: Foundations and Intelligent Paradigms, Volume 3 : Medical, Health, Social, Biological and other Applications, Springer, 2012.

Virtual teaching materials:

1. G TEC Medical Engineering – Brain Computing Interface, http://www.gtec.at/Download.
2. BIOPAC System Inc., http://www.biopac.com/Research.asp.
3. Steven W. Smith, The Scientist and Engineer's Guide to Digital Signal Prcessing http://www.dspguide.com/.
4. http://www.transparentcorp.com/products/np/index.php.
5. Ramaswamy Palaniappan, Biological Signal Analysis, 2010, Ramaswamy Palaniappan & Ventus Publishing ApS, http://www.fulviofrisone.com/attachments/article/415/introduction-to-biological-signal-analysis.pdf.
6. John L. Semmlow, Biomedical Image Processing, MATLAB-Based Applications, Marcel Dekker, Inc., 2004. http://cgrava.webhost.uoradea.ro/teaching/ImaMed/documentatie/Dekker_Biomedical_Image_Processing.pdf.
7. Riccardo de Asmundis, Modeling, Programming and Simulations Using LabVIEW™ Software, INTECH, 2011, http://www.intechopen.com/books/modeling-programming-and-simulations-using-labview-software.

10. Corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in accordance with what is done in other university centers in the country and abroad.
In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad.
The discipline is developed on the basis of internationally recognized field textbooks.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of the final grade
10.1 Course	Knowledge	Written Paper	70%
	Understanding		
10.2 Laboratory	Knowledge and understanding; Ability to explain and interpret; Complete and correct resolution of requirements.	Certified applicative activity/laboratory/practical work/project, etc. Tests throughout the semester. Themes of control. Scientific activities.	Evaluation of laboratory activities 20%
			Active presence 10%
10.3 Minimum Performance Standard			
1. The student knows what the main concepts are, recognizes them, defines them correctly and solves a simple application; 2. The specialized language is simple, but correctly used; 3. Minimum grade of 5 in the laboratory; 4. To solve well a minimum of grid questions and applications.			

Date of completion Signature of the course holder Signature of the laboratory instructor
20.09.2025 Senior lecturer.dr.eng. Corina-Anca Mnerie Senior lecturer.dr.eng. Corina-Anca Mnerie

Date of approval in the department Signature of the department director
26.09.2025 Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council Approval from the Dean
29.09.2026 Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

34. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	FACULTY OF ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Stusy Cycle	BACHELOR OF SCIENCE
1.6. Study Program/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

35. Course Information

2.1 Course Title:	SIGNAL PROCESSING
2.2 Course Lecturer:	Senior Lecturer dr.eng. Corina Anca MNERIE
2.3 Laboratory Instructor:	Senior Lecturer dr.eng. Corina Anca MNERIE
2.4 Year of Study:	4
2.5 Semester	1
2.6 Type of Assessment:	VERIFICATION
2.7 Course Status:	DS-compulsory

36. Estimated Total Time (hours per semester of didactic activities)

3.1. Hours per week	3	of which 3.2 lecture	2	3.3 Laboratory	1
3.4. Total hours in the study plan	42	of which 3.5 lecture	28	3.6 Laboratory	14
Time allocation:					Hours
Study based on course materials, bibliography					10
Additional documentation in library, specialized databases, or field work					10
Preparation for seminars/labs, essays, portfolios					11
Tutoring					-
Examinations					2
Other activities...					-
3.7 Total hours of individual study					33
3.8 Total hours per semester					75
3.9 Number of credits					3

37. Preconditions (where applicable)

4.1. of curriculum	Computer architecture, Numerical methods.
4.2. of competences	Computer architecture, Numerical methods.

38. Conditions (where applicable)

5.1. of conducting the course	Classroom equipped with IT systems (video projector, etc.).

5.2. of conducting the laboratory	Specialized laboratory, computers, signal generators, oscilloscope, acquisition board, appropriate software

39. Specific competencies acquired

Professional competencies	C2. Design electronic systems C7. Perform laboratory tests
Transversal competencies	CT3. Analytical thinking

40. Learning Outcomes

Knowledge	1. Knows and knows how to use specific laboratory equipment. 2. Has knowledge of data analysis and interpretation. 3. He has knowledge of different types of signals. 4. He has knowledge in simulation programs. 5. Think creatively and innovatively.
Skills	1. Perform simulations to verify the functionality and viability of the systems designed before manufacturing. 2. Plan and execute engineering experiments using specific laboratory equipment. 3. Analyzes and interprets experimental data to validate hypotheses or technical performances. 4. It uses dedicated software for signal processing. 5. Think analytically.
Responsibilities and autonomy	1. Has the ability to manage technical projects responsibly and on time. 2. Can work independently or in a team to implement and test automation solutions in a real professional environment. 3. Approach problems critically.

8. Objectives of the discipline (resulting from the grid of specific competences accumulated)

7.1. General objective of the discipline	The course provides an introduction to the issue of real-time signal and information processing by presenting some techniques, methods and procedures that allow the study of processing applications. The main objective of the course is to acquire the notions, the basic techniques used in the conversion, analysis and numerical processing of signals, in the field of time and

	frequency and the formation of skills in their practical application.
7.2. Specific objectives	To learn the basic techniques used in the conversion, analysis and numerical processing of signals and systems, in the time and frequency domain. Design of digital filters. Acquiring image processing techniques

9. Content

9.1 Course	Teaching methods	Observations
1. Introduction to Digital signal processing	Oral presentations. Design PowerPoint slides using the video projector or online. Final discussions.	3 hours
2. Notions of statistics, probability and noise used in signal processing		2 hours
3. Analog numeric and analog numeric conversion of signals.		3 hours
4. Linear systems. Convolution of signals		3 hours
5. Discrete Fourier Transform		3 hours
6. Digital filters and filtration		4 hours
7. Audio Signal Processing		2 hours
8. Forming and displaying images		4 hours
9. Image Progression Techniques		4 hours
Total		28 hours

1. Steven W. Smith - The Scientist and Engineer's Guide to Digital Signal Processing, http://www.dspguide.com/.
2. Mnerie C., Course notes in electronic format, 2025.
3. Mathlab- Digital Signal Proccesing Toolbox; https://www.mathworks.com/help/signal/
4. www.imageJ.net.

9.2 Laboratory:	Teaching methods	Observations
Basic operations with test signals	Matlab Programming/Simulink Simulation/ Hands-on Work	2 hours
Acquisition, processing and use of discrete data. Matlab Apps	Matlab Programming	2 hours
Analog-to-digital conversion. The Alias phenomenon of sinusoids. Dithering Technique Digital-to-analog conversion	Practical work using Infinity Technologie training stands	2 hours
Signal filtering. Case studies for different types of signals	Mathlab/Practical Paper	2 hours
Acquisition of digital images. (Adjusting scanning parameters, purchasing from webcams, etc.)	Specialized equipment / Practical work	2 hours
Applying techniques to improve image quality using various software. Case studies.	Matlab ImageJ	2 hours
Final testing and recoveries		2 hours

	Total	14 hours

Bibliography

1. Mnerie C., Laboratory Tutor/ Files for Simulation in Electronic Format, 2025.
2. https://infinit-technologies.com/product/it-4407-analog-to-digital-converter-trainer/.
3. https://infinit-technologies.com/product/it-4408-digital-to-analog-converter-trainer/.
4. Steven W. Smith - The Scientist and Engineer's Guide to Digital Signal Processing, http://www.dspguide.com/.
5. Mathlab- Digital Signal Proccesing Toolbox; https://www.mathworks.com/help/signal/.
6. www.imageJ.net.

1. Corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline is in accordance with what is done in other university centers in the country and abroad.
In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad.

10. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of the final grade
11.1 Course	Students' ability to acquire knowledge.	Presentation of a paper/application in the field of signal processing – Final evaluation	60%
	Active participation of students in the course.	Evaluation during the semester	10%
11.2 Laboratory			
	Active participation of students in laboratory work.	Oral + practical method (during the semester)	30%
11.3 Minimum Performance Standard			
1. The student knows what the main concepts are, recognizes them, defines them correctly and solves a simple application. 2. Specialized language is simple, but correctly used. 3. To solve well a minimum of theoretical topics and applications. 4. Performing laboratory work.			

Date of completion Signature of the course holder Signature of the laboratory instructor

20.09.2025 Senior lecturer.dr.eng. Corina Anca Mnerie Senior lecturer.dr.eng. Corina Anca Mnerie

Date of approval in the department	Signature of the department director
26.09.2025	Assoc.Prof. dr.eng. Valentin Muller
Date of approval in the faculty council 29.09.2026	Approval from the Dean Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

41. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	FACULTY OF ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORTS
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Study Cycle	BACHELOR OF SCIENCE
1.6. Study Program/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

42. Discipline Data

2.1. Name of the discipline	ADVANCED ADJUSTMENT SYSTEMS
2.2. Course activity holder	Senior Lecturer dr.eng. Corina Anca MNERIE
2.3. Holder of the seminar/laboratory activity	Senior Lecturer dr.eng. Corina Anca MNERIE
2.4. Year of study	4
2.5. Semester	2
2.6. Type of assessment	EXAMINATION
2.7. Discipline regime	DS-mandatory

43. Total estimated time

3.1.Number of hours per week	3	of which 3.2 course	2	3.3 Laboratory	1
3.4.Total hours in the curriculum	42	of which 3.5 courses	28	3.6 Laboratory	14

Time Pool Distribution	Hours
Study by textbook, course material, bibliography and notes	10
Additional documentation in the library, on specialized electronic platforms and in the field	20
Preparation of seminars/laboratories, assignments, papers, portfolios and essays	20
Tutorials	5
Examination	3
Other activities	0
3.7.Total hours of individual study	58
3.9.Total hours per semester	100
3.10.Number of appropriations	4

44. Preconditions (where applicable)

4.1. The Curriculum	Physics, Electrical Engineering, Introduction to Automation and Automatic Tuning Engineering.
4.2. Competences	Physics, Electrical Engineering, Introduction to Automation and Automatic Tuning Engineering.

45. Conditions (where applicable)

5.1. Course Planning	Classroom, equipped with laptop, video projector/smartboard and appropriate software.
5.2. Conducting the laboratory/project	Laboratory room, properly equipped: test stands, computers, network, Internet connection, specialized software.

46. Specific competences acquired

Skills Professional	C5. Design control systems C7. Perform laboratory tests
Transversal competences	CT3. Analytical thinking

47. Learning Outcomes

Knowledge	6. The student knows the principles of classical and adaptive automatic control (feedback, feedforward, regulation) and their application in the design of complex automatic systems. 7. Knows design methods and algorithms for complex systems. 8. Knows and knows how to use specific laboratory equipment. 9. Has knowledge of data analysis and interpretation. 10. Solve problems.
Skills	6. Design the automatic control structure for simple industrial processes. 7. It uses mathematical models and performance criteria in the evaluation of a control system. 8. Integrates and configures hardware and software components into a functional automatic control/adjustment system. 9. Plan and execute engineering experiments using specific laboratory equipment. 10. Analyzes and interprets experimental data to validate hypotheses or technical performances. 11. Think analytically and critically.
Responsibilities and autonomy	4. Evaluates and optimizes the performance of the projected system, assuming responsibility for choosing technical solutions. 5. Has the ability to manage technical projects responsibly and on time.

	6. Can work independently or in a team to implement and test automation solutions in a real professional environment. 7. Has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control) 8. Develop new installs.

48. Objectives of the discipline (resulting from the grid of specific competences accumulated)

8.1.General objective of the discipline	Advanced control systems - the final discipline in the series of disciplines specific to automation and systems engineering. The main objective is to provide students with advanced notions regarding the management and automatic regulation of technical processes that present peculiarities that hinder classic driving.
8.2.Specific objectives	The course deals with various problems of automatic driving of linear and nonlinear processes by presenting structures and design methods for complex control and control systems, etc.

49. Content

9.1 Course	**Teaching methods**	Observations
HEAD. 1. INTRODUCTION TO ADVANCED DRIVING SYSTEMS 1.1. Principled structure of an automated driving system, the basis of advanced automated driving systems 1.2. Structure and functions of a complex management system 1.3. Advanced Leadership Functions 1.4. Possibilities for implementing a complex SCA 1.5. Examples. Case studies	Oral presentations. Hard project-PowerPoint slides by using video-pro-projector. Final discussions.	**6 hours**
HEAD. 2. STRUCTURES OF CONTROL/CONTROL SYSTEMS 2.1. Structures of control/control systems 2.2. Cascade control structure 2.3. RG with two degrees of freedom 2DOF. 2.4. Model-based tuning structures 2.5. State-based adjustment systems	Oral presentations. Designing PowerPoint slides using the video projector. Final discussions.	**10 hours**

HEAD. 3. ADVANCED METHODS OF DESIGNING AUTOMATIC REGULATION SYSTEMS 3.1. Design based on performance indicators 3.2. Design based on frequency characteristics 3.3. Adaptive control systems 3.4. Design based on pole allocation 3.5. Robust adjustment 3.6. Predictive Tuning	Oral presentations. Designing PowerPoint slides using the video projector. Final discussions.	**12 hours**
	Total	**28 hours**

Course bibliography:

1. I. Dumitrache and others: "Automatica" vol. 1. Romanian Academy Publishing House, 2010.
2. I. Dumitrache and others: "Automatica" vol. II Romanian Academy Publishing House, 2013.
3. S. Preitl, R.E. Precup, Z. Preitl: "Structures and algorithms for automatic process management", University Horizons, Timișoara, 2009.
4. V. Bălaș: "The Theory of Systems", Aurel Vlaicu Publishing House, 2012.
5. K.A. Astrom, B. Wittenmark, "Computer-Controlled Systems," Prentice Hall, 1997
6. Åstrom, K.J., Hägglund, T. PID Controllers. Theory, Design and Tuning. Research Triangle Park, North Carolina, 1995
7. Ioan Doré Landau saddle. Adaptive Control. Algorithms, Analysis and Applications, Springer-Verlag London Limited 2011
8. R. S. Burns, Advanced Control Engineering, 2001
9. C. A. Mnerie, S. Preitl and V. Duma, "Performance enhancement of galvanometer scanners using extended control structures," *2013 IEEE 8th International Symposium on Applied Computational Intelligence and Informatics (SACI),* Timisoara, 2013, pp. 127-130, doi: 10.1109/SACI.2013.6608952.
10. Mnerie C. A., Preitl S., Duma V.-F., Classical PID versus predictive control solutions for a galvanometer-based scanner, IEEE Applied Computational Intelligence and Informatics (SACI), 349-353, May 21-23, 2015 doi: 10.1109/SACI.2015.7208227
11. Corina Mnerie, Stefan Preitl, and Virgil-Florin Duma, Galvanometer-Based Scanners: Mathematical Model and Alternative Control Structures for Improved Dynamics and Immunity to Disturbances, International Journal of Structural Stability and Dynamics, 1740006 (**2017**) DOI: http://dx.doi.org/10.1142/S0219455417400065, Print ISSN: 0219-4554, Online ISSN: 1793-6764, IF 1,617 /(2016), IF 2,082 / (2017)
12. C. Mnerie: "Advanced Adjustment Structures", Course Support, electronic version, 2025.

9.2 Laboratory	**Teaching methods**	Observations
1. Modeling and Simulation of Classic Automatic Tuning Structures	Example. Simulation	2 hours
2. PID regulators with two degrees of freedom. Implementation/design/simulation possibilities https://www.mathworks.com/help/control/ug/two-degree-of-freedom-2-dof-pid-controllers.html	Example. Simulation	2 hours

3. Design and testing of the Quanser 2 DOF Ball Balancer system. https://www.quanser.com/products/2-dof-ball-balancer/ https://www.quanser.com/products/magnetic-levitation/	Practical Paper	4 hours
4. Cascade adjustment https://www.mathworks.com/help/control/ug/designing-cascade-control-system-with-pi-controllers.html	Example. Simulation	2 hours
5. Adaptive systems using model-based predictive control. https://www.mathworks.com/help/mpc/ug/adaptive-cruise-control-using-model-predictive-controller.html https://www.mathworks.com/videos/understanding-model-predictive-control-part-1-why-use-mpc--1526484715269.html?s_tid=vid_pers_recs https://www.mathworks.com/videos/understanding-model-predictive-control-part-2-what-is-mpc--1528106359076.html https://www.mathworks.com/videos/understanding-model-predictive-control-part-3-mpc-design-parameters-1530607670393.html	Simulation	2 hours
6. Completion and presentation of works	Testing knowledge and skills acquired in the laboratory	2 hours
	Total	14 hours

Laboratory bibliography:

1. C. Mnerie: "Course and laboratory – Advanced regulation systems", electronic version, 2025.
2. https://www.quanser.com/products/2-dof-ball-balancer/
3. **https://www.quanser.com/products/magnetic-levitation/**
4. **https://www.mathworks.com/help/control/ug/two-degree-of-freedom-2-dof-pid-controllers.html**
5. **https://www.mathworks.com/help/control/ug/designing-cascade-control-system-with-pi-controllers.html**
6. **https://www.mathworks.com/help/simulink/examples/anti-windup-control-using-a-pid-controller.html**
7. **https://www.mathworks.com/help/physmod/sps/ref/discretepicontroller.html**
8. **https://www.mathworks.com/help/mpc/ug/adaptive-cruise-control-using-model-predictive-controller.html**

10. To corroborate the contents of the discipline with the expectations of the representatives of the small epistle community, professional associations and employers representative in the field ofthe programme

The content of the discipline is in accordance with what is done in other university centers in the country and abroad.

In order to better adapt the content of the discipline to the requirements of the labor market, meetings were held both with representatives of the business environment and with other specialized professors from other higher education centers in the country or abroad. The discipline is developed on the basis of internationally recognized field textbooks. Some of the examples presented during the course and seminar were discussed at national and international conferences and presentations.

11. Assessment

Type of activity	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Weight in the final grade
11.1 Course	Knowledge, understanding and ability to apply the notions and concepts presented in the course.	Written paper or grid test	25%
	Solving homework within the imposed deadline.	Evaluation along the way	50%
11.2 Laboratory	Participation, involvement and resolution of the problems proposed in the laboratory.	Evaluation along the way and final	25%
11.3 Minimum Performance Standard			
1. The student knows what the main concepts are, recognizes them, defines them correctly and solves a simple application. 2. Specialized language is simple, but correctly used. 3. To solve well a minimum of theoretical topics and applications. 4. Performing laboratory work.			

Date of completion Signature of the course holder Signature of the laboratory instructor

20.09.2025 Senior Lecturer dr.eng. Corina A. Mnerie Senior Lecturer dr.eng. Corina A. Mnerie

Date of approval in the department Signature of the department director
26.09.2025

Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council Approval from the Dean
29.09.2026 Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	ENGINEERING
1.3 Department	DEPARTMENT OF AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BECHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Data about the discipline

2.1 Name of the discipline	BUILDING AUTOMATION
2.2 Course activity holder	Senior Lecture dr.eng. Flavius-Maxim PETCUȚ
2.3 Laboratory activity instructor	Senior Lecture dr.eng. Flavius-Maxim PETCUȚ
2.4 Year of study	4
2.5 Semester	2
2.6 Type of assessment	VERIFICATION
2.7 Discipline regime	DS - compulsory

3. Total estimated time (hours per semester of teaching activities)

3.1 Number of hours per week	3	of which 3.2 course	2	3.3 Laboratory	1
3.4 Total hours in the curriculum	42	of which 3.5 courses	28	3.6 Laboratory	14
Distribution of the time fund					Hours
Study by textbook, course material, bibliography and notes					25
Additional documentation in the library, on specialized electronic platforms and in the field					10
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					10
Tutorials					5
Examination					5
Other activities...					3
3.7 Total hours of individual study					58
3.8 Total hours per semester					100
3.9 Number of credits					4

4. Preconditions (where applicable)

4.1 of curriculum	Management of electrical, hydraulic and pneumatic drives, Building security systems, Microprocessor systems, Computer networks, Electrical machines and drives 1, Electric machines and drives 2.
1.2 of competences	The continuous application of the accumulated knowledge allows the gradual passage through the chapters, in close connection with the theme of the previously studied subjects.

5. Conditions (where applicable)

5.1 Course	Room with projector
5.2 Conducting the laboratory	Room M321/M323 Computers with Home Assistant, Arduino IDE, MQTT broker Hardware kits (ESP32, sensors, relays, displays, etc.) Network access for simulations and real-time control

6. Specific competencies acquired

Professional competencies	C5. Design control systems - Develop devices that command and manage the behavior of other devices and systems, using the principles of engineering and electronics.
Transversal competencies	CT2. Comply with regulations.

7. Learning Outcomes

Knowledge	- Knows the operating principles of building automation systems (BMS – Building Management Systems). -Understand the role of sensors, actuators, and control modules in building process management. -Knows the architecture of open-source software platforms used in building automation (Node-RED, Home Assistant). -Understand the communication protocols used in the field (MQTT, HTTP, KNX – overview). -Knows the methods of integrating microcontrollers (ESP32, Arduino) into intelligent systems. -Is familiar with applicable procedures and quality standards.
Skills	-Configure sensors and actuators for real building automation applications. -Program microcontrollers (ESP32/Arduino) for controlling lighting, air conditioning and other subsystems. -Uses Node-RED and Home Assistant for the development of logical flows and HMI applications. -Integrates and configures communication protocols for real-time data transmission. -Perform simulations and functionally test automation systems in real or simulated scenarios. -Correctly apply the regulations, procedures and instructions specific to the activity.
Responsibilities and autonomy	-Can independently design and implement a complete smart building automation application. -Evaluates the performance of automation solutions and proposes pertinent technical improvements. -Complies with professional standards and technical norms specific to automation systems.

	-Works efficiently both individually and in a team, taking responsibility for the stages of a project. - Demonstrates the ability to self-inform and adapt to new technologies in the smart-building field. -Respects the principles of professional ethics in all activities carried out.

8. Objectives of the discipline (resulting from the grid of specific competences acquired)

8.1 General objective of the discipline	Develop the skills needed to design and implement intelligent building automation systems, using free software and accessible components.
8.2 Specific objectives	- Knowledge of the architecture of a BMS (Building Management System) system - Use of communication equipment and protocols for lighting control, HVAC, security - Set up and simulate a complete automation application - Integration of a graphical interface for monitoring and ordering

9. Contents

9.1 Course	**Teaching methods**	**Observations**
1. Introduction to smart building automation	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
2. Components of a BMS system	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
3. Sensors, actuators, control modules	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	6 hours
4. Communication Protocols: MQTT, HTTP, KNX (Overview)	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
5. Microcontrollers in automation systems (ESP32/Arduino)	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	2 hours
6. Automation of lighting, air conditioning, security functions	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours
7. Systems integration and testing – case studies	Presentation with multimedia tools, debates and discussions on concrete examples to clarify the concepts presented	4 hours

	TOTAL	28 hours
Course bibliography	1. Flavius Maxim Petcuț – Building automation, course support, electronic – 2025. 2. Sinopoli, R. – Smart Building Systems. 3. Giurgiu, I. – Automation for Smart Buildings, MatrixRom Publishing House. 4. Node-RED Docs – https://nodered.org/docs/.	

9.2 Laboratory	**Teaching methods**	**Observations**
1. Introduction to open-source platforms (Node-RED, Home Assistant) 2. ESP32 programming for sensor and relay control 3. Lighting automation and HVAC control in simulation 4. Creating a complete app: Smart Camera	1. Hands-on demo (live demo): The instructor introduces the Node-RED and Home Assistant interfaces, installation, configuration, and some simple flows. - Guided Exploration Learning: Students are given small tasks such as creating a basic automation flow in Node-RED or adding a virtual device in Home Assistant. - Hands-on team workshops: Groups solve mini-projects, analyzing the advantages and limitations of each platform. - Case Studies: Presenting real-world IoT solutions that use these platforms to understand architecture and applicability. - Interactive Micro-Assessments: Quick questionnaires to check understanding. 2. Hands-on coding: Students write code directly on the ESP32 using the Arduino IDE or PlatformIO, with incrementally constructed examples. - Thematic labs: Exercises such as reading values from DHT22 sensors, PIR, light, and activating relays. - Problem-Based Learning (PBL): Each student/team has to solve a practical situation, for example: controlling a light bulb based on a motion sensor. - Assisted Debugging: The teacher presents techniques for	14 hours

	identifying errors, using Serial Monitor, charts and logs. - Applied mini-projects: Design of a simple automation module — for example, temperature control or a smart socket. 3. Software simulations (Tinkercad, Proteus, Home Assistant + Device Simulator): Creating a virtual environment where scenarios without real hardware can be tested. - Scenario modeling: Students design lighting automations based on rules (time, motion, ambient light) or HVAC setups based on temperature and humidity. - Behavior analysis: The results of different control scenarios for energy efficiency are compared. - Teamwork: Each team designs a complete automation flow (e.g., optimizing consumption at night). - Gamification: Point system for energy-optimized scenarios or for robust configurations. 4. Capstone project: Students combine everything they have learned to create a smart camera: sensors, ESP32, automations, integration into Home Assistant. - "Learning-by-doing" method: Each component of the room (lighting, temperature, presence, control via the app) is developed step by step. - Agile sprints: The project is divided into stages (sprints) with clear objectives: data acquisition, processing, control, interface. - Presentation and demonstration: Each student/team presents their final solution, explaining the architecture and the challenges encountered. - Iterative feedback: The teacher provides feedback at the end of each step, encouraging the refinement of solutions.	

	TOTAL	**14 hours**
Laboratory bibliography	1. Flavius Maxim Petcuț – laboratory notes in electronic format, 2025. 2. Official Node-RED documentation. 3. ESPHome tutorials, Arduino IDE. 4. Data sheets for sensors and components used.	

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The contents of the discipline Building Automation have been developed in accordance with current developments in the field of intelligent systems, international trends regarding the digitalization of infrastructures and the requirements of the industry. The thematic structure reflects the skills required by employers in the field of automation, IoT, facility management and smart-building.

The validation of the contents was carried out by:

- aligning the theme with similar programs from prestigious universities in the country and abroad;
- consultations with industry specialists (automation companies, smart-building solution integrators, IoT system providers) on the current needs of the market;
- recommendations of relevant professional associations (e.g.: ASHRAE, KNX Association, IEEE IoT initiatives);
- analysis of the real requirements in the building installation sector, where the integration of smart equipment, open protocols and modern software platforms is needed;
- the professional and research experience of the course holder in the field of automation systems and smart building technologies.

The theoretical and applied contents are regularly updated to reflect technological progress (modern microcontrollers, IoT protocols, open-source platforms, HMI interfaces), as well as the needs of employers who require engineers capable of designing, implementing and managing integrated systems in modern buildings.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage the final grade
11.1 Course	- Understanding theoretical concepts - Ability to analyze and integrate information - Knowledge of BMS, sensors, protocols	Written exam, evaluation of participation	50%
11.2 Laboratory	- Correct application of knowledge in practical exercises	Practice tests, application project (full "smart room" application), homework	50%

	- ESP32 programming / Node-RED configuration - Making an automation mini-application - Ability to work in a team and use documentation	and active attendance check	

11.3 Minimum Performance Standard

- Know and explain the fundamental concepts of building automation.
- Correctly configure at least one sensor and actuator in a simple application.
- Demonstrate the operation of an elementary flow in or a simple application on ESP32.
- To obtain at least a grade of 5 both in the exam and in the test on laboratory activities.
- To use the specialized language correctly and to solve at least half of the theoretical and practical requirements proposed.

Date of completion	Signature of the course holder	Signature of the laboratory instructor
20.09.2025	Senior lecture.dr.eng. Flavius M. Petcuț	Senior lecture.dr.eng. Flavius M. Petcuț

Date of approval in the department	Signature of the department director
26.09.2025	Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council	Approval from the Dean
29.09.2026	Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	ENGINEERING
1.3 Department	DEPARTMENT OF AUTOMATION, INDUSTRIAL ENGINEERING AND TEXTILES
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Data about the discipline

2.1 Name of the discipline	ELECTRICAL AND ELECTRONIC AUTOMATION EQUIPMENT
2.2 Course activity holder	Senior Lecture dr. eng. Flavius-Maxim PETCUȚ
2.3 Laboratory activity instructor	Senior Lecture dr. eng. Flavius-Maxim PETCUȚ
2.4 Year of study	4
2.5 Semester	2
2.6 Type of assessment	EXAMINATION
2.7 Discipline regime	DS-Optional

3. Total estimated time (hours per semester of teaching activities)

3.1 Number of hours per week	4	of which 3.2 course	2	3.3 Laboratory	2
3.4 Total hours in the curriculum	56	of which 3.5 courses	28	3.6 Laboratory	28
Distribution of the time fund					Hours
Study by textbook, course material, bibliography and notes					20
Additional documentation in the library, on specialized electronic platforms and in the field					10
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					10
Tutorial					2
Examination					2
Other activities...					0
3.7 Total hours of individual study					44
3.8 Total hours per semester					100
3.9 Number of credits					4

4. Preconditions (where applicable)

4.1 of curriculum	Microcontroller Programming Knowledge, Systems Theory Knowledge, Electrical, Hydraulic and Pneumatic Drive Management, Microprocessor Systems, Computer Networks,
4.2 of competencies	The continuity of the applicative capitalization of the acquired knowledge allows a gradual passage through the

	chapters, in close relationship with the theme of the previously studied subjects.

5. Conditions (where applicable)

5.1 Course	Interactive whiteboard, Microsoft Office, Matlab-Simulink.
5.2 Conducting the laboratory	Laboratory equipment – Quanser stands, microcontrollers, Matlab-Simulink, hardware kits (ESP32, sensors, relays, displays, etc.), network access for simulations and real-time control

6. Specific competencies acquired

Professional competencies	C2. Electronics. C4. Analyze production processes for improvement.
Transversal competencies	CT1. Work in teams. CT3. Think analytically.

7. Learning Outcomes

Knowledge	The student/graduate: He has knowledge of electronic schematics and methods of designing electronic systems. Has knowledge in simulation programs Define performance indicators. Propose and validate optimization solutions to reduce costs and increase efficiency. Know the principles and stages of teamwork. Know ways to communicate and collaborate effectively. It processes information, ideas and concepts. Solve problems. Think creatively and innovatively.
Skills	The student/graduate: Make electronic schematics and printed circuit boards using specialized software. Perform simulations to verify the functionality and viability of systems designed before manufacturing. Identify losses and non-conformities in the production process based on performance indicators. Propose and validate optimization solutions to reduce costs and increase efficiency. Actively participates in team activities, contributing to the achievement of common goals. Demonstrates the ability to negotiate and resolve conflicts constructively. Think analytically. Think critically. Think creatively.
Responsibilities and autonomy	The student/graduate: Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions.

	Can work independently or in a team to implement and test automation solutions in a real professional environment. Has the ability to manage technical projects responsibly and on time. It has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). Evaluates and optimizes the performance of the designed system, taking responsibility for choosing technical solutions. Can work independently or in a team to implement and test automation solutions in a real professional environment. Has the ability to manage technical projects responsibly and on time. They take on their own tasks and respect the deadlines set in the team. Contribute to a positive and productive team climate. Approach problems critically. Analyzes experimental laboratory data. Develop new installations.

8. Objectives of the discipline (resulting from the grid of specific competences acquired)

8.1 General objective of the discipline	The general objective of Electrical and Electronic Automation Equipment is to train the theoretical and practical skills necessary for the design and implementation of embedded systems using microcontrollers, peripherals, engineering methods and modern hardware-software tools.
8.2 Specific objectives	Understanding the architecture of microcontrollers. Programming peripherals: GPIO, Timers, ADC, PWM. Use of UART, SPI, I2C interfaces. Real-time application development and use of RTOS. Integration of sensors and actuators into embedded applications. Using troubleshooting and testing tools.

9. Contents

9.1 Course	**Teaching methods**	**Observations**
1. Introduction to automation 1.1 Definition and role of automated systems. 1.2 Classification of industrial processes (continuous, sequential, hybrid). 1.3 The general structure of an automatic system: signal, measuring chain, regulating chain. 1.4 Types of equipment used in automation.	Lecture, explanations, examples	4 hours

2. Automatic systems 2.1 Models of automated systems: feedback, feedforward. 2.2 Systems behavior: stability, transient response, steady-state response. 2.3 Introduction to automatic size adjustment: flow, level, pressure, temperature, speed. 2.4 Conventional systems vs. numerical systems. 2.5 Presentation of the SCADA concept and the hierarchy of process management.	Lecture, explanations, examples	4 hours
3. Components: sensors, actuators, control blocks. 3.1. Sensors (transducers) - Transducers of temperature, pressure, level, flow, concentration. - Types of signals (analog, numeric). - Signal conditioning and processing. 3.2. Actuators - Electric motors (AC, DC, servo motors). - Solenoid valves, pneumatic and hydraulic actuators. - Classic and modern drives (VFD, soft-starter). 3.3. Control blocks - Relays, time relays, auxiliary contacts. - Analog and numeric PID controllers. - PLC: architecture, programming languages (Ladder, Grafcet). - HMI interface and integration into SCADA systems.	Lecture, explanations, examples	4 hours
4. Electrical control and protection equipment - Contactors, fuses, thermal and magnetic protections. - Protection relays, optical relays, surveillance modules. - Control and distribution panels. - Implementation of start/stop circuits, motor protection, interlocks.	Lecture, explanations, examples	4 hours

- Examples of control schemes used in automation.		
5. Automatic controllers and PID control - The principle of automatic adjustment. - Analog controllers vs. numerical controllers. - PID algorithm: P, I, D – operation, setting, tuning. - Implementation of PID in industrial controllers and PLCs. - Examples: regulating temperature, pressure, level, speed.	Lecture, explanations, examples	4 hours
6. Digital automation systems and SCADA - Real-time data acquisition and processing. - Structure of SCADA, HMI, RTU systems. - Industrial communication protocols: Modbus, Profibus, Profinet. - Monitoring, alarming, data archiving. - Integration of electrical/electronic equipment into SCADA systems.	Lecture, explanations, examples	4 hours
7. Programmable Logic Controllers (PLCs) and Applications - PLC architecture; I/O modules, communication modules. - Programming languages (Ladder). - Sequential and continuous programming. - Realization of the control logic schemes: engine start/stop, interlocks, protections. - Practical applications in industrial processes.		4 hours
	TOTAL	28 hours

Course bibliography:

1. Flavius Maxim Petcuț, Electrical and Electronic Automation Equipment, course support - updated electronic version, 2025.
2. STMicroelectronics – STM32 documentation. https://www.st.com/en/microcontrollers-microprocessors/stm32-32-bit-arm-cortex-mcus.html.
3. Microchip – Guides and applications for PIC microcontrollers. https://www.microchip.com/en-us/products/microcontrollers-and-microprocessors
4. ESP-IDF Documentation – Espressif Systems, https://docs.espressif.com/.
5. I. Dumitrache, Automatic Tuning Engineering, new revised edition, Politehnica Press Publishing House, 2010.
6. Corneliu Lazar, Draguna Vrabie, Sorin Carari - Automatic Systems with PID Regulators, Matrixrom Publishing House, Bucharest, 2004.
7. Octavian Proştean, Ioan Filip, C. Vaşar, I. Szeidert - Modeling and Simulation, University Horizons Publishing House, Timişoara, 2006.

9.2 Laboratory	**Teaching methods**	**Observations**
Measurement of basic electrical quantities	Hands-on activities, demonstrations	4 hours
Practical studies with relays, contactors and control buttons	Hands-on activities, demonstrations	6 hours
Installation of engine start/stop circuits	Hands-on activities, demonstrations	4 hours
Use of sensors and signal modulation	Hands-on activities, demonstrations	2 hours
Interface of electrical equipment with electronic modules	Hands-on activities, demonstrations	2 hours
Programming a simple control on a mini-PLC/microcontroller (ESP32/Arduino) and introduction to SCADA	Hands-on activities, demonstrations	4 hours
Introduction to Ladder Programming: Ladder Charts, Timers, Interlocks, Counters.	Hands-on activities, demonstrations	2 hours
Realization of an integrated application: mini-automation system (e.g. control of a pump, fan, conveyor belt)	Hands-on activities, demonstrations	2 hours
Automatic adjustment and PID (temperature/level) tuning. P, PI, PID	Hands-on activities, demonstrations	2 hours

principles; manual tuning; transient and stationary response.		
	TOTAL	28 hours

Laboratory bibliography:

1. Flavius Maxim Petcuț, Electrical and Electronic Automation Equipment, Laboratory Support - Electronic Version, 2025.
2. STMicroelectronics – STM32 documentation. https://www.st.com/en/microcontrollers-microprocessors/stm32-32-bit-arm-cortex-mcus.html.
3. Microchip – Guides and applications for PIC microcontrollers. https://www.microchip.com/en-us/products/microcontrollers-and-microprocessors
4. ESP-IDF Documentation – Espressif Systems, https://docs.espressif.com/.
5. I. Dumitrache, Automatic Tuning Engineering, new revised edition, Politehnica Press Publishing House, 2010.
6. Corneliu Lazar, Draguna Vrabie, Sorin Carari - Automatic Systems with PID Regulators, Matrixrom Publishing House, Bucharest, 2004.
7. Proştean O, etc. – Modeling and Simulation, University Horizons Publishing House, Timişoara, 2006.

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The contents of the discipline Electrical and Electronic Automation Equipment are aligned with the current requirements of the academic community and the industry. The thematic structure of the course and the applied activities was established in relation to similar programs in important universities in the country and abroad, as well as to the recommendations of professional bodies in the field of electrical engineering, automation and information technology.

In order to ensure professional relevance, the content of the discipline was analyzed and correlated with:

- the expectations of employers in the field of Electrical and Electronic Automation Equipment;
- consultations with specialists from the economic environment, who confirmed the importance of practical training in the field of Electrical and Electronic Automation Equipment;
- the recommendations of the epistemic community on updating the topic in accordance with recent technological developments (ARM microcontrollers, ESP32, low-power wireless communications, IoT, cyber-physical systems);
- international academic practices, taken from recognized textbooks and materials used at renowned technical universities.

Also:

- The examples used in the course and the laboratory are the result of collaborations with the industrial environment, as well as the participation of teachers in conferences and projects in the field of embedded systems.

- The contents support research and innovation activity, being used in projects, bachelor's theses and extracurricular activities focused on robotics, IoT devices and automation applications.

Thus, the discipline responds to the needs of both the professional environment and those of the academic community, ensuring the formation of relevant skills in the long term.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of final grade
11.1 Course	knowledge understanding	Written exam. Questions with topics taken from the course. Course activity.	60%
11.2 Laboratory	- knowledge and understanding; - the ability to explain and interpret; - complete and correct resolution of requirements.	- the certified applicative activity/laboratory/practical work/project, etc. - Semester testing - Control Themes - scientific activities	Final laboratory evaluation 10% Evaluation of laboratory activities 20% Active participation in laboratories 10%
11.3 Minimum Performance Standard			
1. The student knows what the main concepts are, recognizes them, defines them correctly and solves a simple application; 2. The specialized language is simple, but correctly used; 3. Minimum grade 5 at the final evaluation at the laboratory; 4. To solve well a minimum of grid questions and applications.			

Date of completion Signature of the course holder Signature of the laboratory instructor

20.09.2025 Senior lecture.dr.eng. Flavius M. Petcuț Senior lecture.dr.eng. Flavius M. Petcuț

Date of approval in the department Signature of the department director

26.09.2025 Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council Approval from the Dean

29.09.2026 Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

1. Program Information

1.1 Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2 Faculty	ENGINEERING
1.3 Department	DEPARTMENT OF AUTOMATION, INDUSTRIAL ENGINEERING AND TEXTILES
1.4 Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5 Study Cycle	BACHELOR OF SCIENCE
1.6 Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

2. Course Information

2.1 Name of the discipline	EMBEDDED SYSTEMS
2.2 Course activity holder	Senior Lecture dr. eng. Flavius-Maxim PETCUȚ
2.3Laboratory activity instructor	Senior Lecture dr. eng. Flavius-Maxim PETCUȚ
2.4 Year of study	4
2.5 Semester	2
2.6 Type of assessment	EXAMINATION
2.7 Discipline regime	DS-Optional

3. Total estimated time (hours per semester of teaching activities)

3.1 Number of hours per week	4	of which 3.2 course	2	3.3 Laboratory	2
3.4 Total hours in the curriculum	56	of which 3.5 courses	28	3.6 Laboratory	28
Distribution of the time fund					Hours
Study by textbook, course material, bibliography and notes					12
Additional documentation in the library, on specialized electronic platforms and in the field					10
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					10
Tutorial					4
Examination					4
Other activities...					4
3.7 Total hours of individual study					44
3.8 Total hours per semester					100
3.9 Number of credits					4

4. Preconditions (where applicable)

4.1 of curriculum	Knowledge of Microcontroller Programming, Knowledge of Systems Theory, Conduction of Electrical, Hydraulic and Pneumatic Drives, Microprocessor Systems, Computer Networks,
4.2 of competences	The continuity of the applied capitalization of the acquired knowledge allows a gradual passage through the chapters, in close relation with the theme of the previously studied subjects.

5. Conditions (where applicable)

5.1 Course	Interactive whiteboard, Microsoft Office, Matlab-Simulink.
5.2 Conducting the laboratory	Laboratory equipment – Quanser stands, microcontrollers, Matlab-Simulink, hardware kits (ESP32, sensors, relays, displays, etc.), network access for simulations and real-time control

6. Specific competencies acquired

Professional competencies	C2. Design electronic systems - Sketch and design electronic systems, products and components, using computer aided design (CAD) software and equipment. Perform a simulation so that an assessment of the viability of the product can be carried out and that the physical parameters can be examined before the actual construction of the product. C4. Analyze production processes for improvement - Analyze production processes for improvements. Perform analyses to reduce production losses and overall manufacturing costs. C8. Model and simulate sensors - Model and simulate sensors, produced with the help of sensors and sensor components, using engineering design software. The viability of the product can thus be evaluated and the physical parameters can be examined before the actual construction of the product.
Transversal competencies	CT1. Work in teams - Work confidently within a group, each doing their part in serving the whole. CT3. Think analytically – Think using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.

7. Learning Outcomes

Knowledge	The student/graduate: -Knows the architecture of microcontrollers and the operation of the main peripherals (GPIO, Timers, ADC, PWM). -Understand the principles of serial communications used in embedded systems: UART, SPI, I2C. -Understand the fundamentals of real-time operating systems (RTOS) and how to use them in embedded applications. -Know the hardware and software design stages for the development of a complete embedded system. -Recognizes development and debugging tools used in embedded systems engineering (IDEs, debugger, logic analyzer, oscilloscope). -Has basic knowledge of sensors and measuring equipment. -Knows the principles and stages of teamwork. -Knows ways of effective communication and collaboration. -Processes information, ideas and concepts. -Solve problems.

Skills	The student/graduate: -Configure and program microcontrollers in C/C++ language for embedded applications. -Integrates sensors, actuators, and communication modules into functional embedded designs. -Use interruptions, peripherals, and communication protocols in an efficient and correct manner. -Apply real-time programming techniques using an RTOS. -Use specific tools for troubleshooting and testing embedded systems. -Develops and documents a complete technical project, which includes both hardware and software. Design, implement and test embedded applications, taking responsibility for the technical decisions made. -Evaluates and optimizes the performance of an embedded system based on technical and functional criteria. -Works independently or in a team in the development of embedded solutions, efficiently managing the assigned tasks. -Adapt the developed solutions to real requirements in the professional environment, including in emerging fields such as IoT and intelligent automation. -Shows availability for continuous learning, professional updating and the adoption of modern technologies in the field of embedded systems. -Think analytically and creatively.
Responsibilities and autonomy	The student/graduate: -Evaluates and optimizes the performance of the designed system, assuming responsibility for choosing technical solutions. -Can work independently or in a team to implement and test automation solutions in a real professional environment. -Can work independently or in a team to implement and test automation solutions in a real professional environment. -Has the ability to manage technical projects responsibly and on time. -Assumes his/her own tasks and respects the deadlines set in the team. -Approaches problems critically. It analyzes experimental laboratory data.

8. Objectives of the discipline (resulting from the grid of specific competences acquired)

8.1 General objective of the discipline	To train the theoretical and practical skills necessary for the design and implementation of embedded systems using microcontrollers, peripherals and modern hardware-software tools.
8.2 Specific objectives	Understanding the architecture of microcontrollers. Programming peripherals: GPIO, Timers, ADC, PWM. Use of UART, SPI, I2C interfaces. Real-time application

	development and use of RTOS. Integration of sensors and actuators into embedded applications. Using troubleshooting and testing tools.

9. Contents

9.1 Course	**Teaching methods**	**Observations**
Introduction to embedded systems. Microcontroller architecture. ADCs and timers.	Lecture, explanations, examples	10 hours
ADC converter, PWM generation, serial communications: UART, SPI, I2C.	Lecture, explanations, examples	10 hours
Outages and their management.	Lecture, explanations, examples	2 hours
Real-time operating systems (RTOS). Code optimization. Wireless modules.	Lecture, explanations, examples	4 hours
Hardware design principles and testing/debugging techniques.	Lecture, explanations, examples	2 hours
	TOTAL	**28 hours**

Course bibliography:

1. Flavius-Maxim Petcuț, course note in electronic format, 2025.
2. STMicroelectronics – STM32 Documentation, https://www.st.com/en/microcontrollers-microprocessors/stm32-32-bit-arm-cortex-mcus.html .
3. Microchip – Guides and Applications for PIC Microcontrollers, https://www.microchip.com/en-us/products/microcontrollers-and-microprocessors.
4. ESP-IDF Documentation – Espressif Systems, https://docs.espressif.com/.

9.2 Laboratory	**Teaching methods**	**Observations**
Setting up the development environment and programming arduino.	Hands-on activities, demonstrations	4 hours
Reading analog and digital sensors.	Hands-on activities, demonstrations	8 hours
Generation of PWM signals.	Hands-on activities, demonstrations	4 hours
Using the UART interface.	Hands-on activities, demonstrations	2 hours

Use of SPI/I2C interfaces.	Hands-on activities, demonstrations	2 hours
Application of Real-Time Operating Systems (RTOS) in embedded systems.	Hands-on activities, demonstrations	6 hours
Final project: development of an embedded application.	Hands-on activities, demonstrations	2 hours
	TOTAL	**28 hours**

Laboratory bibliography:

1. Flavius-Maxim Petcuț, course note in electronic format, 2025.
2. STMicroelectronics – STM32 documentation, https://www.st.com/en/microcontrollers-microprocessors/stm32-32-bit-arm-cortex-mcus.html.
3. Microchip – Guides and Applications for PIC Microcontrollers, https://www.microchip.com/en-us/products/microcontrollers-and-microprocessors
4. ESP-IDF Documentation – Espressif Systems, https://docs.espressif.com/.

10. Corroboration/validation of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The contents of the embedded systems discipline are aligned with the current requirements of the academic community and the industry. The thematic structure of the course and the applied activities was established in relation to similar programs in important universities in the country and abroad, as well as to the recommendations of professional bodies in the field of electrical engineering, automation and information technology.
In order to ensure professional relevance, the content of the discipline was analyzed and correlated with:

- the expectations of employers in the fields of embedded systems, IoT, industrial automation and the electronics industry, which require skills in microcontroller programming, sensor integration, the use of communication protocols and working with troubleshooting tools;
- consultations with business specialists, who confirmed the importance of practical training in the field of serial interfaces, real-time systems (RTOS) and the development of embedded prototypes;
- the recommendations of the epistemic community on updating the topic in accordance with recent technological developments (ARM microcontrollers, ESP32, low-power wireless communications, IoT, cyber-physical systems);
- international academic practices, taken from recognized textbooks and materials used at renowned technical universities.

Also:

- The examples used in the course, laboratory and seminar are the result of collaborations with the industrial environment, as well as the participation of teachers in conferences and projects in the field of embedded systems.

- The contents support research and innovation activity, being used in projects, bachelor's theses and extracurricular activities focused on robotics, IoT devices and automation applications.

Thus, the discipline responds to the needs of both the professional environment and those of the academic community, ensuring the formation of relevant skills in the long term.

11. Assessment

Type of activity	Evaluation criteria	Evaluation methods	Percentage of the final grade
11.1 Course	Knowledge Understanding	Written exam. Questions with topics taken from the course. Course activity.	60%
11.2 Laboratory	Knowledge and understanding. Ability to explain and interpret. Complete and correct resolution of requirements.	Certified applicative activity/laboratory/practical work/project, etc. Tests throughout the semester. Control Themes Scientific activities	Final evaluation of the seminar 10% Evaluation of laboratory activities 20% Active presence 10%
11.3 Minimum Performance Standard			
1. The student knows what the main concepts are, recognizes them, defines them correctly and solves a simple application. 2. Specialized language is simple, but correctly used. 3. Minimum grade of 5 in the seminar and laboratory. 4. To solve well a minimum of grid questions and applications.			

Date of completion Signature of the course holder Signature of the laboratory instructor

20.09.2025 Senior lecture.dr.eng. Flavius-M. Petcuț Senior lecture.dr.eng. Flavius-M. Petcuț

Date of approval in the department Signature of the department director

26.09.2025 Assoc.Prof. dr.eng. Valentin Dan Muller

Date of approval in the faculty council Approval from the Dean

29.09.2026 Senior lecturer.dr.eng. Corina-Anca Mnerie

SYLLABUS

50. Program Information

1.1. Higher education institution	AUREL VLAICU UNIVERSITY OF ARAD
1.2. Faculty	ENGINEERING
1.3. Department	AUTOMATION, INDUSTRIAL ENGINEERING, TEXTILES AND TRANSPORT
1.4. Field of study	AUTOMATION, APPLIED INFORMATICS AND INTELLIGENT SYSTEMS
1.5. Cycle of studies	BACHELOR OF SCIENCE
1.6. Study Programme/Qualification	AUTOMATION AND APPLIED INFORMATICS (IN ENGLISH) (AIA-E)

51. Course Information

2.1. Name of the discipline	DIPLOMA PROJECT DEVELOPMENT
2.2. Course activity holder	
2.3. Project activity holder	
2.4. Year of study	4
2.5. Semester	2
2.6. Type of assessment	VERIFICATION
2.7. Discipline regime	DS-compulsory

52. Total estimated time

3.1.Number of hours per week	1	of which 3.2 course		3.3 Project	5
3.4.Total hours in the curriculum	70	of which 3.5 courses	28	3.6 Project	70
Time Pool Distribution					Hours
Study by textbook, course material, bibliography and notes					25
Additional documentation in the library, on specialized electronic platforms and in the field					20
Preparation of seminars/laboratories, assignments, papers, portfolios and essays					5
Tutorials					5
Examination					5
Other activities					-
3.7.Total hours of individual study					**55**
3.9.Total hours per semester					**125**
3.10.Number of appropriations					**5**

53. Preconditions (where applicable)

4.1.de curriculum	
4.2.de competences	

54. Conditions (where applicable)

5.1.de course	
5.2.de of the project	Attendance is mandatory.

6. Specific competencies acquired

Professional competencies	- C4 - Analyze everything about production with a view to improvement. - C5 - Design control systems. - C8 - Model and simulate sensors. - C9 - Develop open source software.
Transversal competencies	- CT1 - Work in teams. - CT2 – Comply with regulations. - CT3 - Think analytically.

7. Learning Outcomes

Knowledge	Graduate: -Define performance indicators. -Proposes and validates optimization solutions to reduce costs and increase efficiency. -Understand the basic and advanced principles of automatic control (feedback, stability, tuning) and their application in the design of automatic systems. -Know the structure, operation and interaction of hardware and software components in an industrial control system (sensors, actuators, controllers, interfaces) - Knows how to mathematically model dynamical systems. - Has basic knowledge of sensors and measuring equipment. -Knows how to mathematically model dynamical systems. Has basic knowledge of sensors and measuring equipment. -Knows the principles and stages of teamwork - Know ways to communicate and collaborate effectively -Knows the principles of professional ethics and deontology -Is familiar with applicable procedures and quality standards -Processes information, ideas and concepts -Solve problems -Think creatively and innovatively
Skills	Graduate: -Identifies losses and non-conformities in the production process based on performance indicators. -Proposes and validates optimization solutions to reduce costs and increase efficiency. -Design automatic control structures for industrial processes using mathematical models and performance criteria. -Integrates and configures hardware components (PLCs, microcontrollers, industrial communication networks) and software into a functional automatic control/control system.

	Develop functional models for sensors and interfacing circuits using simulation software. Evaluate the system's response to variations in physical parameters by numerical simulation. It uses open-source platforms and libraries for the development of technical software applications. -Applies licensing and collaboration principles in open source software projects, respecting the standards of the open-source community Actively participates in team activities, contributing to the achievement of common goals. -Demonstrates the ability to negotiate and resolve conflicts constructively -Correctly apply the regulations, procedures and instructions specific to the activity -Proposes solutions to improve compliance with rules and procedures -Think analytically -Think critically -Think creatively
Responsibilities and autonomy	-Evaluates and optimizes the performance of the designed system, assuming responsibility for choosing technical solutions. -Can work independently or in a team to implement and test automation solutions in a real professional environment. -Has the ability to manage technical projects responsibly and on time. -Has availability for continuous learning and professional adaptation in emerging fields (intelligent automation, IoT, AI in control). -Approaches issues critically -Analyzes experimental laboratory data -Develop new installations

8. Objectives of the discipline (resulting from the grid of specific competences acquired)

8.1 General objective of the discipline	Subject matter according to the specifications of the diploma project.
8.2 Specific objectives	Development of practical skills. Developing research capacity.

13. Content

9.1 Course	Teaching methods	Observations

9.2 Laboratory	Teaching methods	Observations
Research and development activities	Supervision and guidance by the diploma advisor.	

14. Corroboration of the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

The content of the discipline, together with the skills and abilities acquired, correspond to the expectations of the professional organizations in the field, the companies in the field where the students carry out their internship activities and/or occupy a job, as well as the national and international quality assurance bodies (ARACIS). It also ensures the adoption of ethical standards appropriate to engineering practice.

15. Assessment

Completion date	Holders	Title, Name, Surname	Signature
	Course		
	Applications		

Date of completion
20.09.2025

Signature of the department director

Assoc.prof.dr.eng. Valentin Dan Muller

Date of approval in the department

26.09.2025

Dean Signature

Senior lecture dr.eng. Corina-Anca Mnerie

Date of approval in the faculty council
29.09.2026

Approval from the Dean
Senior lecturer.dr.eng. Corina-Anca Mnerie

Vizat manager proiect,

Nicoleta DUMITRAȘCU

SYLLABUS MODUL 2

Antreprenoriatul – aspecte economico-financiare

Obiective generale

Oferirea unei baze teoretice pentru orientarea studenţilor în domeniul afacerilor și analiza procesului antreprenorial pe baza modelelor specifice activității economico-financiare.

- Formarea unui set de cunoștințe economico-financiare utile în eficientizarea unei afaceri, atât din punct de vedere al costurilor, cât și din punct de vedere al performanțelor.

Competenţe profesionale:

CP3. Construirea unor modele de analiză și diagnoză a principalelor aspecte presupuse de un proces antreprenorial ţinând cont de specificitatea acestuia;

CP4. Aplicarea metodelor și instrumentelor de analiză a mediului socio-economic în vederea identificării oportunităților și resurselor utile în dezvoltarea unor afaceri în domenii specifice

CP5. Utilizarea cunoștințelor teoretice în proiectarea/elaborarea a unui plan de afaceri în domenii specifice de activitate

Competențe transversale

CT1. Aplicarea principiilor, normelor și valorilor de etică profesională în cadrul propriei strategii de muncă riguroasă, eficientă și responsabilă în priectarea și implementarea activităților antreprenoriale

Tema 1. Antreprenor și antreprenoriat. Abordări conceptuale și funcționale

1.1: *Definirea conceptului de antreprenor şi antreprenoriat*

1.2.: *Trăsăturile și caracteristicile antreprenoriatului*

Obiective specifice:

La finalul formării, cursanţii vor fi capabili să:

- O.S.1.1.- considere iniţierea propriei afaceri ca o posibilitate de evoluţie în carieră, o alternativă la constrângerile opţiunii de a fi angajat;
- O.S.1.2.- ia deciziile ce însoţesc iniţierea unei afaceri;

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
4	**2**	**2**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
30		Noțiuni introductive privind antreprenoriatul	Definiții existente despre antreprenoriat.	- Expunerea - Discuţia - Dezbaterea	Video proiector
30	40	Profilul antreprenorial	Realizarea unui profil antreprenorial prin prezentarea temelor dominante și a diverselor mituri despre antreprenori.	- Prelegerea - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Video proiector
30	20	Calitățile personale ale antreprenorului	Antreprenorii sunt caracterizați ca interacțiune între mai multe calități.	- Explicația - Discuţia	Video proiector
30	30	Acțiunile întreprinse de antreprenori	Dezbateri privind acțiunile antreprenoriale, caracteristici și calități ale antreprenorilor.	- Dezbaterea - Problematizarea	Video proiector
	30	Factori care influențează activitatea antreprenorială	Prezentarea factorilor interni și externi. Impactul factorilor asupra decizilor antreprenoriale. Feedback privind rezultatele activităților practice din sesiunea de	- Studiul de caz - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Fișe de lucru

			lucru.		

Rezumatul temei: Sesiunea de formare durează patru ore. Pe parcursul sesiunii vor fi prezentate cinci teme structurate astfel: patru părți de prezentare teoretică și patru de aplicații practice. În prima parte teoretică va fi definit antreprenoriatul și antreprenorul, în a doua parte vor fi prezentate temele dominante ale profilului antreprenorial. În treia și a patra parte a cursului se vor prezenta calitățile personale ale antreprenorului și acțiunile întreprinse de acesta. Referitor la partea aplicativă se va realiza un profil antreprenorial de către cursanți prin prezentarea temelor dominante și a diverselor mituri despre antreprenori, vor avea loc dezbateri privind acțiunile antreprenoriale, caracteristici și calități ale antreprenorilor și discuții privind impactul factorilor interni și externi asupra decizilor antreprenoriale.

Strategiile de formare utilizate

Pe parcursul temei 1 formatorii vor utiliza, cu precădere, următoarele strategii și metode de formare și de învățare:

- Expunerea
- Prelegerea
- Probelmatizarea
- Studiul de caz
- Discuţia
- Dezbaterea
- Învăţarea prin descoperire
- Învăţarea prin cooperare

Strategia evaluării pe parcurs din cadrul temei 1

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității formabililor, în timpul destinat organizării față în față. În acest scop se va dialoga cu formabilii, li se vor adresa întrebări pentru a stabili cunoaşterea terminologiei specifice, capacitatea de utilizare a noţiunilor specifice și capacitatea de a utiliza cunoştinţele acumulate pentru conceperea și dezvoltarea unei afaceri

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Vizat manager proiect,

Nicoleta DUMITRAȘCU

SYLLABUS

Modul 3

Managementul afacerii în domeniul ingineriei mecanice

Competențe profesionale:
CP3 Construirea unor modele de analiză şi diagnoză a principalelor aspecte presupuse de un proces antreprenorial ţinând cont de specificitatea acestuia;

CP4 Aplicarea metodelor și instrumentelor de analiză a mediului socio-economic în vederea identificării oportunităților și resurselor utile în dezvoltarea unor afaceri în domeniul ingineriei mecanice;

CP5 Utilizarea cunoștințelor teoretice în proiectarea/elaborarea a unui plan de afaceri în domeniul ingineriei mecanice;

CP6 Diagnosticarea disfuncțiilor și a riscurilor posibile în implementarea unei inițiative antreprenoriale în domeniul ingineriei mecanice.

Competențe transversale
CT1 – Aplicarea principiilor, normelor și valorilor de etică profesională în cadrul propriei strategii de muncă riguroasă, eficientă și responsabilă în proiectarea și implementarea activităților antreprenoriale
CT2 – Formularea, cercetarea și implementarea de procedee și tehnici de comunicare și relaționare pentru optimizarea cooperării în cadrul echipei, în context antreprenorial

Obiectivul general:

- Formarea la studenți a a competențelor – în plan cognitiv, acțional și atitudinal - necesare lansării unei afaceri în domeniul inginerie mecanică prin oferirea unui ghid de orientare a unui antreprenor în deciziile ce însoţesc iniţierea unei afaceri în domeniul inginerie mecanică.

Tema 1: Întreprinderea în inginerie mecanică

Obiective specifice:
La finalul formării, cursanții vor fi capabili să:

- O.S.1.1 - să realizeze/interpreteze o cercetare de piață în domeniul ingineriei mecanice;
- O.S.1.2 - să stabilească structura unui plan de afaceri în domeniul ingineriei mecanice;
- O.S.1.3 - să descrie etapele întocmirii unui plan de afaceri, cu referiri la ingineriei mecanică;
- O.S.1.4 – să sistematizeze și să prelucreze informații legate de planul de afaceri;
- O.S.1.5 – să descrie în mod succint o afacere în domeniul ingineriei mecanice;
- O.S.1.6. – să întocmească o fișă de post pentru organigrama unei firme din domeniul ingineriei mecanice

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (Ap)**	**Evaluare (Ev)**
4	**2**	**2**	

1. Managementul afacerii în inginerie mecanică
1.1. Funcțiile întreprinderii
1.2. Mediul de afaceri, mediul întreprinderii
1.3. Cultura organizațională a firmelor din domeniul ingineriei mecanice
1.4. IMM-uri din domeniul ingineriei mecanice și dificultățile acestora

Durata min		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
25		1.1. Funcțiile întreprinderii	Prezentarea funcțiilor de aprovizionare, producție, personal, financiar-contabilă, cercetare-dezvoltare	Prezentare Expunere Exemplificare Prezentare interactivă	Laptop, videoproiector, ecran,
25		1.2. Mediul de afaceri, mediul întreprinderii	Prezentarea mediului intern si a mediului extern al unei întreprinderi din domeniul ingineriei mecanice	Prezentare Expunere Exemplificare Prezentare interactivă	Laptop, videoproiector, ecran,
25		1.3. Cultura organizațională a firmelor din domeniul ingineriei	Prezentarea culturii organizaționale a firmelor din domeniul ingineriei mecanice	Prezentare interactivă	Laptop, videoproiector, ecran,

		mecanice			
25		1.4. IMM-uri din domeniul ingineriei mecanice și dificultățile acestora	Prezentarea dificultăților de ordin managerial, educativ, bancar, comercial al întreprinderilor mici și mijlocii din domeniul ingineriei mecanice	Expunere Exemplificare Prezentare interactivă	Laptop, videoproiector, ecran,
	25	1.1. Funcțiile întreprinderii	Reluarea pe scurt a prezentării funcțiilor de aprovizionare, producție, personal, financiar-contabilă, cercetare-dezvoltare. Lucru pe grupuri , fiecare grup dezvoltând aspecte despre o anumită funcție a întreprinderii	Ice breacking Dezbatere Munca în echipă Învățarea prin cooperare	Suport de curs,
	25	1.2. Mediul de afaceri, mediul întreprinderii	Reluarea pe scurt a prezentării mediului intern si a mediului extern al unei întreprinderi din domeniul industriei alimentare. Lucru pe grupuri, fiecare grup dezvoltând aspecte despre mediul intern respectiv extern al întreprinderii.	Dezbatere Munca în echipă Învățarea prin cooperare	Suport de curs, Acces la internet
	25	1.3. Cultura organizațională a firmelor din domeniul ingineriei mecanice	Reluarea pe scurt a prezentării culturii organizaționale a firmelor din domeniul ingineriei mecanice. Lucru pe grupuri, fiecare grup dezvoltând aspecte despre cultura organizațională.	Învățarea prin cooperare Discuții de grup	Suport de curs,
	25	1.4. IMM-uri din domeniul ingineriei mecanice și dificultățile acestora	Reluarea pe scurt a prezentării dificultăților de ordin managerial, educativ, bancar, comercial al întreprinderilor mici și mijlocii in domeniul ingineriei mecanice. Lucru pe grupuri, fiecare grup dezvoltând aspecte despre diverse dificultăți ale IMM-urilor domeniul ingineriei mecanice.	Dezbatere Munca în echipă Învățarea prin cooperare	Suport de curs,

Rezumatul temei

Sesiunea de formare durează 4 ore. În prima parte teoretică vor fi identificate date/informații specifice antreprenoriatului în domeniul ingineriei mecanice necesare pentru demararea unei

afaceri în acest domeniu. Cursanții vor afla despre cei trei factori care contează : datele/informațiile, modalitățile de colectare și sursa datelor. În a doua parte, care va fi partea practică se va folosi metoda brainstorming cu tema: *Funcțiile întreprinderii și Dificultăți ale IMM-urilor din domeniul ingineriei mecanice*, urmând astfel să se stabilească care sunt funcțiile întreprinderii din domeniul ingineriei mecanice și dificultățile cu care se confruntă IMM-urile din acest domeniu. Aceste secvențe teoretice vor fi urmate de aplicații practice în care cursanții vor analiza studii de caz referitoare la domeniul ingineriei mecanice (confecții metalice, mobilier, servicii în domeniul auto, etc.).

Strategiile de formare utilizate

Pe parcursul Temei 1 formatorul utilizează, cu precădere, următoarele strategii și metode de formare și de învățare:

- Dezbaterea/Conversaţia
- Prezentari interactive
- Discutii de grup
- Lucru in echipa
- Aplicatii practice
- Exemplificarea
- Studiul/Analiza de caz
- Brainstorming
- Învățarea prin descoperire

Strategia evaluării pe parcurs din cadrul Temei 1

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității studenților, în timpul destinat organizării față în față. În acest scop se va dialoga cu studenții, li se vor adresa întrebări și li se va solicita prezentarea propriei experiențe.

Evaluarea constă și în verificarea însuşirii corecte a conceptelor teoretice și aplicarea acestora în cazuri concrete.

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Tema 2. Antreprenoriat în domeniul ingineriei mecanice

Obiective specifice:
La finalul formării, cursanţii vor fi capabili să:

- O.S.1.1 - să realizeze/interpreteze o cercetare de piață în domeniul ingineriei mecanice;
- O.S.1.2 - să stabilească structura unui plan de afaceri în domeniul ingineriei mecanice
- O.S.1.3 - să descrie etapele întocmirii unui plan de afaceri, cu referiri la domeniul ingineriei mecanice;
- O.S.1.4 – să sistematizeze și să prelucreze informații legate de planul de afaceri;
- O.S.1.5 – să descrie în mod succint o afacere în domeniul ingineriei mecanice;
- O.S.1.6. – să întocmească o fișă de post pentru organigrama unei firme din domeniul ingineriei mecanice

Competenţe specifice:

- CP1 – Stabilirea, evaluarea, interpretarea și dezvoltarea de strategii, programe și proiecte în domeniul administrării afacerilor în domeniul ingineriei mecanice
- CP3 – Planificarea detaliată a veniturilor şi cheltuielilor, reducerea semnificativă a riscului apariției problemelor cu fluxul de numerar în ceea ce privește afacerea din domeniul ingineriei mecanice
- CP4 – întărirea abilităților de planificare ale antreprenorului, care va fi mai bine pregătit şi capabil să se adapteze mai rapid la schimbări;
- CT1 – Aplicarea principiilor, normelor și valorilor de etică profesională în cadrul propriei strategii de muncă riguroasă, eficientă și responsabilă;
- CT2 – Formularea, cercetarea și implementarea de procedee și tehnici de comunicare și relaționare pentru optimizarea cooperării în cadrul echipei

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (Ap)**	**Evaluare (Ev)**
8	**4**	**4**	

2. Antreprenoriat în domeniul ingineriei mecanice
2.1. Rolul economic și social al antreprenoriatului din domeniul ingineriei mecanice
2.2. Definirea, caracteristicile şi identificarea oportunităţilor de afaceri din domeniul ingineriei mecanice
2.3. Oportunități de afaceri și identificarea lor în domeniul ingineriei mecanice

Durata min		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
50		2.1.Rolul economic și social al antreprenoriatului din domeniul	Prezentarea rolului economic și social al antreprenoriatului din domeniul ingineriei	Prezentare interactivă	Laptop, videoproiector, ecran,

		ingineriei mecanice	mecanice		
50		2.2.Definirea, caracteristicile şi identificarea oportunităţilor de afaceri din domeniul ingineriei mecanice	Prezentarea definiției, a caracteristicilor și identificării oportunităților de afaceri din domeniul ingineriei mecanice	Expunere Exemplificare Prezentare interactivă	Laptop, videoproiector, ecran,
100		2.3..Oportunități de afaceri și identificarea lor în domeniul ingineriei mecanice	Prezentarea oportunităților de afaceri și a modului de identificare a lor în domeniul ingineriei mecanice (construcții metalice, prelucrări mecanice, mobilier, servicii in domeniul auto, etc.)	Ice breacking Prezentare Expunere Exemplificare Prezentare interactivă	Laptop, videoproiector, ecran,
	50	2.1.Rolul economic și social al antreprenoriatului din domeniul ingineriei mecanice	Prezentarea pe scurt a rolului economic și social al antreprenoriatului din domeniul ingineriei mecanice - lucru pe grupuri.	Dezbatere	Laptop, videoproiector, ecran,
	50	2.2. Definirea, caracteristicile şi identificarea oportunităţilor de afaceri din domeniul ingineriei mecanice	Prezentarea pe scurt a definiției, caracteristicilor și identificării oportunităților de afaceri din domeniul ingineriei mecanice - lucru pe grupuri.	Ice breacking Dezbatere	Suport de curs,
	100	2.3..Oportunități de afaceri și identificarea lor în domeniul ingineriei mecanice	Prezentarea pe scurt a oportunităților de afaceri și identificarea lor din domeniul ingineriei mecanice - lucru pe grupuri, fiecare grup dezvoltând oportunități de afaceri din zona de domiciliu.	Dezbatere Braintorming Munca în echipă Învățarea prin cooperare Discuții de grup	Suport de curs,

Rezumatul temei

Sesiunea de formare durează 4 ore curs și 4 ore aplicații. În prima parte teoretică va fi prezentat rolul economic și social al antreprenoriatului în domeniul ingineriei mecanice. Apoi se prezintă definirea, caracteristicile și identificarea oportunităților de afaceri în domeniul ingineriei mecanice. Prelegerea continuă cu prezentarea de oportunități de afaceri în domeniul ingineriei mecanice. Cursanții vor afla despre cei trei factori care contează : datele/informațiile, modalitățile de colectare și sursa datelor. În a doua parte, care va fi partea practică se vor folosi metoda lucrului pe grupuri și în interiorul grupurilor, metoda brainstorming cu tema: *Oportunități de afaceri în domeniul ingineriei mecanice în zonele de domiciliu*, urmând ca grupurile să fie constituite după principalele sectoare de activitate din

domeniu. Secvențele teoretice vor fi urmate de aplicații practice în care cursanții vor analiza studii de caz referitoare la domeniul ingineriei mecanice.

Strategiile de formare utilizate

Pe parcursul Temei 2 formatorul utilizează, cu precădere, următoarele strategii și metode de formare și de învățare:

- Dezbaterea/Conversaţia
- Prezentari interactive
- Discutii de grup
- Lucru in echipa
- Joc de rol
- Aplicatii practice
- Exemplificarea
- Studiul/Analiza de caz
- Exerciţiul
- Brainstorming
- Învățarea prin descoperire

Strategia evaluării pe parcurs din cadrul Temei 2

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității studenților, în timpul destinat organizării față în față. În acest scop se va dialoga cu studenții, li se vor adresa întrebări și li se va solicita prezentarea propriei experiențe.

Evaluarea constă și în verificarea însuşirii corecte a conceptelor teoretice și aplicarea acestora în cazuri concrete.

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Tema 3: Etapele întocmirii planului de afaceri în domeniul ingineriei mecanice

Obiective specifice:
La finalul formării, cursanţii vor fi capabili să:

- O.S.1.1 - să interpreteze și să realizeze o cercetare de piață în domeniul ingineriei mecanice;
- O.S.1.2 - să stabilească stuctura unui plan de afaceri în domeniul ingineriei mecanice
- O.S.1.3 - să descrie etapele întocmirii unui plan de afaceri, cu referiri la domeniul ingineriei mecanice;
- O.S.1.4 – să sistematizeze și să prelucreze informații legate de planul de afaceri;
- O.S.1.5 – să descrie în mod succint o afacere în domeniul ingineriei mecanice.

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
6	**4**	**2**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
	15	Exercițiu introductiv	Participanții vor prezenta pe scurt ideea lor de afaceri în domeniul ingineriei mecanice. Ei vor nota pe o coală de hârtie esențialul în maxim 5 rânduri.	Exercițiul, Turul galeriei	Foi A4, markere
30		Colectarea informațiilor	Identificarea informațiilor și a datelor necesare, modalitățile de colectare și interpretare a acestora în vederea elaborării unui plan de afaceri în domeniul ingineriei mecanice.	Dezbatere Expunere Studiul de caz	Prezentările video Suport de curs
90		Structura planului de afaceri	Stabilirea structurii unui plan de afaceri și a etapelor necesare întocmirii acestuia (domeniul ingineriei mecanice) 1. Pagina de titlu 2. Rezumatul 3. Descrierea proiectului de afacere 3.1 Descrierea produselor / serviciilor 3.2 Analiza pieței 3.3 Strategia de marketing 3.4 Analiza financiară	Brainstorming Dezbatere Exercițiul	Flip-chart, markere, foi de flipchart Suport de curs Videoproiector Laptop

			3.5 Obiective. Planul operațional 3.6 Analiza swot 3.7 Organizarea și managementul afacerii		
	50	Structura planului de afaceri. Studii de caz în domeniul ingineriei mecanice.	Utilizarea unor exemplificări practice pentru sedimentarea și înțelegerea părții teoretice. Activitatea practică are la bază, întrebarea: *Ce informații trebuie să conțină planul de afaceri?* Răspunsurile obținute se vor sintetiza, stabilindu-se structura planului de afaceri (domeniul ingineriei mecanice) pentru o firmă nou înființată	Exemplificarea Învățarea prin descoperire	Videoproiector Laptop
60		Conținutul planului de afaceri	Sistematizarea datelor și prelucrarea lor în vederea elaborării planului de afaceri. 1. Pagina de titlu (Denumire și forma juridică de constituire, Codurile CAEN, Adresă sediu, Telefon, Email, Asociați) 2. Rezumatul (descrierea pe scurt a afacerii și susținerea unor argumente care să susțină faptul că ideea este de succes; informații pe scurt despre istoricul companiei, se va prezenta misiunea, valorile și obiectivele pe termen scurt și lung) 3. Descrierea proiectului de afacere 3.1 Descrierea produselor sau serviciilor, beneficii pentru clienți, stadiul de dezvoltare, tehnologia folosită 3.2 Analiza pieței și a concurenței (informații despre piața țintă, cota de piață, potențialul de creștere, segmentarea pieței, descrierea publicului țintă, prezentarea nevoilor și trendurilor) 3.3 Strategia de marketing (strategiile de produs, de preț	Expunerea Problematizarea Explicația Simularea	Suport de curs Prezentare Power Point Videoproiector Laptop

			și de promovare)		
60		Conținutul planului de afaceri (continuare)	3.4 Analiza financiară (cheltuieli estimate pentru lansare, producție, promovare, salarii și altele pe o perioada de cel puțin un an, estimare atingere break-even (pragul de rentabilitate) 3.5 Obiective. Planul operațional. (obiective, activități, termene) 3.6 Analiza swot 3.7 Organizarea și managementul afacerii (structura organizațională, echipa de management, plan de recrutare si instruire, sarcini și responsabilități)	Învățarea prin cooperare Explicația Simularea	Suport de curs Prezentare Power Point Videoproiector Laptop
	50	Conținutul planului de afaceri. Studii de caz în domeniul ingineriei mecanice	Dezbaterea unor planuri de afaceri. Se stabilesc cinci criterii minimale de eligibilitate a planurilor de afaceri și pentru planurile elaborate, studenții împărțiți pe echipe de câte 4 studenți, urmăresc îndeplinirea acestor criterii.	Exercițiu Simularea Munca în echipă	Prezentare Power Point Videoproiector Laptop Fișe de lucru
	5	Momentul de apreciere	Fiecare student scrie pe o hârtie aprecierile sale față de modul în care s-a realizat predarea și față de lucrurile noi pe care le-a învățat	Exercițiul	Foi A4

Rezumatul temei

Sesiunea de formare durează 6 ore. În prima parte teoretică vor fi identificate date și informații specifice antreprenoriatului în domeniul ingineriei mecanice necesare pentru demararea unei afaceri în acest domeniu. Cursanții vor afla despre cei trei factori care contează : datele/informațiile, modalitățile de colectare și sursa datelor. În a doua parte teoretică se va folosi metoda brainstorming cu tema: *Ce informații conține un plan de afaceri?*, urmând astfel să se stabilească structura planului de afaceri în domeniul ingineriei mecanice și etapele realizării lui. Aceste secvențe teoretice vor fi urmate de aplicații practice în care cursanții vor analiza studii de caz referitoare la structura și etapele întocmirii planului de afaceri din domeniul ingineriei mecanice. În a treia secvență teoretică este stabilit conținutul unui plan de afaceri din domeniul ingineriei mecanice. În completarea acestei secvențe teoretice, secvența aplicativă propune dezbaterea unor planuri de afaceri în domeniul ingineriei mecanice, subliniind punctele tari și punctele slabe ale acestora.

Strategiile de formare utilizate

Pe parcursul acestei teme formatorul utilizează următoarele strategii și metode de formare și de învățare:

- Dezbaterea/Conversaţia
- Exemplificarea
- Studiul/Analiza de caz
- Exercițiul
- Brainstorming
- Învățarea prin descoperire
- Lucrul în echipe

Strategia evaluării pe parcurs

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității studenților, în timpul destinat organizării față în față. În acest scop se va dialoga cu studenții, li se vor adresa întrebări și li se va solicita prezentarea propriei experiențe.

Evaluarea constă și în verificarea însușirii corecte a conceptelor teoretice și aplicarea acestora în cazuri concrete.

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Tema 4: Dezvoltarea unui plan de afaceri în domeniul ingineriei mecanice

Obiective specifice:
La finalul formării, cursanţii vor fi capabili să:

- O.S.1.1 - să interpreteze și să realizeze o cercetare de piață în domeniul ingineriei mecanice;
- O.S.1.2 - să stabilească stuctura unui plan de afaceri în domeniul ingineriei mecanice
- O.S.1.3 - să descrie etapele întocmirii unui plan de afaceri, cu referiri la domeniul ingineriei mecanice;
- O.S.1.4 – să sistematizeze și să prelucreze informații legate de planul de afaceri;
- O.S.1.5 – să descrie în mod succint o afacere în domeniul ingineriei mecanice.

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
8	**4**	**4**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
60		Prezentarea afacerii. Descrierea ideii de afaceri.	Viziune. Strategie. Obiective. Ideea de afaceri. Produse sau servicii oferite. În cazul unei afaceri deja existente se face un scurt istoric al firmei.	Dezbatere Expunere	Prezentările video Suport de curs
	60	Prezentarea afacerii. Descrierea ideii de afaceri.	Se prezintă activitatea desfășurată cu prezentarea produselor; locul în care se desfăşoară activitatea (infrastructura publică, utilităţi, forţa de muncă etc.), principalii furnizori de materii prime şi materiale, dotările cu maşini, utilaje, mijloace de transport, imobilele deţinute, prezentarea clienţilor, principalii concurenţi.	Dezbatere Expunere	Prezentările video Suport de curs
60		Echipa de management. Analiza mediului extern.	Se prezintă experiența antreprenorului și a membrilor cheie a echipei de proiect. Oportunități și amenințări ale mediului extern. Analiza potențialilor clienți. Analiza concurenței.	Brainstorming Dezbatere Expunere	Flip-chart, markere, foi de flipchart Suport de curs Videoproiector Laptop
	60	Echipa de management.	Finanțatorul planului de afaceri trebuie să fie convins	Exemplificarea Învățarea prin	Videoproiector Laptop

		Analiza mediului extern.	că afacerea va fi gestionată de o echipă de profesioniști. Această secțiune conține următoarele informații: • Conducerea firmei (responsabilităţi, pregătire, experienţă/ locuri de muncă anterioare • Prezentarea conducerii firmei / iniţiatorilor afacerii este necesară mai ales în cazul noilor afaceri. Contribuţia proprietarilor/ managerilor la capitalul firmei. • Numărul de salariaţi (poate fi prezentată organigrama firmei). Analiza mediului extern presupune înțelegerea faptului că firma este o componentă a mediului extern, în care intră cumpărătorii, furnizorii de materii prime și materiale, concurenții, partenerii de afaceri, finanțatorii, statul, etc. Este important ca, pentru înființarea unei afaceri acest mediu să fie analizat cu atenție. În acest sens se face: documentarea; analiza clientului și înțelegerea nevoilor sale; alegerea poziției pe piață; analiza concurenței.	descoperire	
60		Strategia de marketing	Strategia de marketing presupune sistematizarea datelor legate de strategia de produs, strategia de preț, strategia de distribuție, strategia de promovare.	Expunerea Problematizarea Explicația Simularea	Suport de curs Prezentare Power Point Videoproiector Laptop

	60	Strategia de marketing	Strategia de marketing cuprinde: 1. Strategia de produs - analizați atent ceea ce veți vinde. Câte produse/ servicii? Câte game de produse? Care este nivelul calitativ? Care este elementul de noutate? Prin ce sunt diferite față de alte produse/ servicii? Planul de afaceri trebuie să ofere o descriere suficient de detaliată a produsului/ serviciului firmei, cu indicarea caracteristicilor calitative și a avantajelor. 2. Strategia de preț - cu ce preț veți vinde produsele/serviciile? Ce reduceri de preț veți aplica? Când veți acorda reduceri? Cum vă propuneți să fidelizați clienții? Ce pachete de produse/ servicii veți oferi? 3. Strategia de distribuție Veți vinde direct? Veți apela la distribuitori? Ce avantaje oferiți distribuitorilor? Veți prezenta date referitoare la modalitatea de vânzare a produsului/ serviciului (de exemplu, prin magazine proprii, prin mici magazine din zonă sau prin comenzi prin poştă etc.). 4. Strategia de promovare Prin ce anume vreți să fie reținute produsele dumneavoastră? Cum vreți să vă promovați?	Învățarea prin cooperare Explicația Simularea	Suport de curs Prezentare Power Point Videoproiector Laptop
60		Analiza financiară	Bugetul de investiții Previziunea veniturilor Previziunea cheltuielilor Previziunea fluxurilor de numerar Indicatori financiari	Exercițiu Simularea Munca în echipă	Prezentare Power Point Videoproiector Laptop Fișe de lucru
	60	Analiza financiară	Planul financiar presupune o atenție deosebită documentelor referitoare la aspectele financiare ale	Exercițiu Simularea Munca în echipă	Prezentare Power Point Videoproiector Laptop

			afacerii prezentate astfel: evoluţia estimată a veniturilor şi cheltuielilor afacerii pentru următoarea perioadă de timp - de regulă următorii câţiva ani, indicatori de rentabilitate etc. Bugetul investiţiei trebuie să includă: • Costuri de investiţii: costul lucrărilor de construcţie, inclusiv costul asigurării utilităţilor (infrastructura, apă, gaz, canalizare etc), costul achiziţiei de echipamente, utilaje, alte bunuri de capital • Alte costuri: cheltuieli de proiectare şi consultanţă, cheltuieli pentru probe tehnologice, cheltuieli pentru instruirea personalului, etc. Sursele de finanțare ale afacerii pot fi: • Surse proprii: o aport al asociaţilor/acţionarilor o autofinanţarea din sursele excedentare ale întreprinderii • Surse atrase: o Credite bancare o Fonduri nerambursabil Estimarea veniturilor și a cheltuielilor. Determinarea indicatorilor financiari și a indicatorilor investiției.		Fișe de lucru

Rezumatul temei

Sesiunea de formare durează 8 ore. În prima parte teoretică vor fi identificate date și informații specifice antreprenoriatului în domeniul ingineriei mecanice necesare pentru demararea unei afaceri în acest domeniu. Cursanții vor afla cum se prezintă o afacere respectiv cum se descrie afacerea. În a doua parte teoretică este prezentată echipa de management, respectiv modalitatea de analiză a mediului extern. Aceste secvențe teoretice vor fi urmate de aplicații practice în care cursanții vor analiza studii de caz referitoare la structura și etapele întocmirii planului de afaceri din domeniul ingineriei mecanice. În continuarea secvență teoretică prezintă strategia de marketing și analiza financiară. Cursantul parcurgând aceste secvențe teoretice este capabil să stabilească conținutul unui plan de afaceri din domeniul ingineriei mecanice, subliniind punctele tari și punctele slabe ale acestuia.

Strategiile de formare utilizate

Pe parcursul acestei teme formatorul utilizează următoarele strategii și metode de formare și de învățare:

- Dezbaterea/Conversaţia

- Exemplificarea
- Studiul/Analiza de caz
- Exercițiul
- Brainstorming
- Învățarea prin descoperire
- Lucrul în echipe

Strategia evaluării pe parcurs

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității studenților, în timpul destinat organizării față în față. În acest scop se va dialoga cu studenții, li se vor adresa întrebări și li se va solicita prezentarea propriei experiențe.
Evaluarea constă și în verificarea însușirii corecte a conceptelor teoretice și aplicarea acestora în cazuri concrete.

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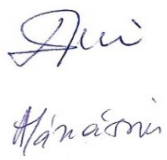
Semnătura,



Tema 2. Antreprenorul și mediul de afaceri

Obiective specifice:

La finalul formării, cursanţii vor fi capabili să:

- O.S.2.- identifice elemente ale mediului de afaceri local și celui național care influențează înființarea și dezvoltarea afacerilor;

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
6	**2**	**4**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
60		Identificarea mediului de afaceri	Prezentarea pieței interne Analizarea mediului de afaceri Prezentarea factorilor care influențează mediul de afaceri	- Expunerea - Discuţia - Dezbaterea	Video proiector
30	60	Rolul mediului de afaceri în stimularea antreprenoriatului	Discuții referitoare la satisfacţiile activităţii antreprenoriale Discuții referitoare la insatisfacţiile activităţii antreprenoriale	- Studiul de caz - Discuţia - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Video proiector
30	60	Oportunități antreprenoriale și crearea de noi afaceri	Modalităţile de identificare a oportunităţilor	- Discuţia - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Fișe de lucru
	60	Identificarea oportunităților de afaceri	Dezbateri privind evaluarea oportunităţilor de afaceri	- Problematizarea - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Fișe de evaluare și analiză
	60	Conceperea și dezvoltarea unei afaceri	Impactul pieței asupra deciziilor antreprenoriale. Feedback privind rezultatele activităților practice din sesiunea de	- Exercițiul - Discuţia - Dezbaterea - Învăţarea prin descoperire	Video proiector

			lucru.	- Învăţarea prin cooperare	

Rezumatul temei: Sesiunea de formare durează șase ore, două ore de curs și patru de activități practice. Pe parcursul sesiunii vor fi prezentate cinci teme structurate astfel: trei părți de prezentare teoretică și patru de aplicații practice. În prima parte teoretică va fi analizat mediul de afaceri prin prisma pieței, în a doua parte se va prezenta rolul mediului de afaceri în stimularea antreprenoriatului iar în a treia parte a cursului vor fi prezentate oportunități antreprenoriale și beneficiile creării de noi afaceri. Referitor la partea aplicativă vor avea loc discuții referitoare la satisfacţiile și insatisfacțiile activităţii antreprenoriale, dezbateri privind modalităţile de identificare a oportunităţilor de afaceri și evaluarea oportunităţilor precum și impactul mediului de afaceri și a factorilor externi asupra deciziilor antreprenoriale.

Strategiile de formare utilizate

Pe parcursul temei 2 formatorii vor utiliza, cu precădere, următoarele strategii și metode de formare și de învățare:

- Expunerea
- Exercițiul
- Studiul de caz
- Problematizarea
- Discuţia
- Dezbaterea
- Învăţarea prin descoperire
- Învăţarea prin cooperare

Strategia evaluării pe parcurs din cadrul temei 2

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității formabililor, în timpul destinat organizării față în față. În acest scop se va dialoga cu formabilii, li se vor adresa întrebări pentru a stabili cunoaşterea terminologiei specifice, capacitatea de utilizare a noţiunilor specifice și capacitatea de a utiliza cunoştinţele acumulate pentru conceperea și dezvoltarea unei afaceri

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Tema 3. Noțiuni legislative din domeniul economico-financiar

Obiective specifice:

La finalul formării, cursanţii vor fi capabili să:

- O.S.3.1.- cunoască formele de organizare a persoanelor juridice în România în urma prezentării legislației în domeniul juridic;
- O.S.3.2.- cunoască și să aplice legislația fiscală reglementată de Codul fiscal;

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
2	**2**	**-**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
60		Alegerea unei anumite forme de organizare juridică a activității antreprenoriale	Prezentarea formelor de organizare a societăților comerciale Asemănări și deosebiri între diferitele forme de organizare juridică	- Prelegerea interactivă - Problematizarea	Video proiector
60		Prezentarea legislației fiscale conform codului fiscal	Clasificarea impozitelor după trăsăturile de fond și formă Prezentarea Impozit pe venit vs. impozit pe profit Prelegere refeeritoare la cotele de TVA aplicate în România Prezentarea și exemplificarea legislației în cazul venitului salarial	- Discuţia - Prelegerea interactivă - Învăţarea prin descoperire - Învăţarea prin cooperare	Video proiector

Rezumatul temei: Sesiunea de formare durează două ore de curs. Pe parcursul sesiunii vor fi prezentate două teme teoretice. În prima parte va fi prezentată legislația privind formele de organizare a societăților comerciale necesară unui viitor antreprenor la înființarea societății. În a doua parte se va prezenta legislația fiscală referitoare la impozitele și taxele ce revin societăților după înființare. Se face o paralelă între impozitele plătite de persoanele juridice în

urma desfășurării activității, legislația impozitelor indirecte ca urmare a achiziției și livrării de bunuri și servicii și prezentarea costurilor cu remunerarea personalului.

Strategiile de formare utilizate

Pe parcursul temei 3 formatorii vor utiliza, cu precădere, următoarele strategii și metode de formare și de învățare:

- Problematizarea
- Discuţia
- Prelegerea interactivă
- Învăţarea prin descoperire
- Învăţarea prin cooperare

Strategia evaluării pe parcurs din cadrul temei 3

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității formabililor, în timpul destinat organizării față în față. În acest scop se va dialoga cu formabilii, li se vor adresa întrebări pentru a stabili cunoaşterea terminologiei specifice, capacitatea de utilizare a noţiunilor specifice și capacitatea de a utiliza cunoştinţele acumulate pentru conceperea și dezvoltarea unei afaceri

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4. Năstase, G., Ghidul consultantului în afaceri, Editura Prouniversitaria, Bucureşti, 2010
5. Legea 31/1990 privind Societățile Comerciale
6. Legea 227/2015 privind Codul Fiscal

Formator: Condea Bogdan Virgil

Tema 4. Surse de finanțare pentru dezvoltarea societății

Obiective specifice:

La finalul formării, cursanţii vor fi capabili să:

- O.S.4. - cunoască modalitățile de finanțare pe care o întreprindere le are la dispoziție în scopul dezvoltării activității antreprenoriale;

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
6	**2**	**4**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
30	60	Surse proprii interne de finanțare	Autofinanțarea-autonomie și stabilitate financiară Etapele autofinanțării Costul autofinanțării	- Discuţia - Prelegerea interactivă - Învăţarea prin descoperire	Video proiector
30	60	Surse proprii externe de finanțare	Aporturi noi de capital în funcție de forma juridică de organizare a societății Indicatori care caracterizează eficiența financiară	- Exercițiul - Prelegerea interactivă - Discuţia - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Video proiector
20	40	Creditele bancare	Formele creditului bancar Costul creditului bancar Avantajele/dezavantajele utilizării creditului bancar	- Exercițiul - Explicația - Învăţarea prin descoperire - Învăţarea prin cooperare	Video proiector
20	20	Împrumutul obligatar	Definirea noțiunii de obligațiune Caracteristicile împrumutului obligatar Elementele obligațiunii	- Prelegere interactivă - Discuţia - Dezbaterea - Învăţarea prin descoperire - Învăţarea prin cooperare	Video proiector
20	60	Leasing-ul	Formele leasing-ului Fazele operațiunii de leasing Feedback privind rezultatele activităților practice din sesiunea de lucru.	- Învăţarea prin descoperire - Învăţarea prin cooperare - Exercițiul - Explicația	Fișe de lucru

Rezumatul temei: Sesiunea de formare durează șase ore, două ore de curs și patru de activități practice. Pe parcursul sesiunii vor fi prezentate cinci teme de prezentare teoretică și de aplicații practice. În prima parte teoretică vor fi clasificate sursele de finanțare la dispoziția societăților și prezentarea surselor proprii interne de finanțare. Prima parte aplicativă este dedicată prezentării etapelor autofinanțării și calculul costului aferent acestei surse de finanțare. Partea a doua prezintă sursele proprii externe de finanțare și calculul indicatorilor care caracterizează eficiența financiară în cazul finanțării. În partea a treia teoretică sunt prezentate formele creditului bancar iar la partea aplicativă costul creditului bancar și discutii cu privire la avantajele și dezavantajele utilizării acestei surse externe de finanțare. Ultimele două părți ale temei surprind alte două surse externe de finanțare, la fiecare prezentând definiție, caracteristici, elemente componente, partea aplicativă constând în exemplificarea și simularea unui împrumut obligatar și a celor două forme de leasing. În partea de final a temei vor avea loc discuții referitoare la alegerea unei surse de finanțare cât mai optimă pentru o societate aleasă.

Strategiile de formare utilizate

Pe parcursul temei 4 formatorii vor utiliza, cu precădere, următoarele strategii și metode de formare și de învățare:

- Prelegerea interactivă
- Problematizarea
- Exercițiul
- Explicația
- Discuţia
- Dezbaterea
- Învăţarea prin descoperire
- Învăţarea prin cooperare

Strategia evaluării pe parcurs din cadrul temei 4

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității formabililor, în timpul destinat organizării față în față. În acest scop se va dialoga cu formabilii, li se vor adresa întrebări pentru a stabili cunoaşterea terminologiei specifice, capacitatea de utilizare a noţiunilor specifice și capacitatea de a utiliza cunoştinţele acumulate pentru conceperea și dezvoltarea unei afaceri

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10. Tăgăduan, D., Gomoi, B., Gestiunea financiară a întreprinderii, Arad, Editura Universităţii „Aurel Vlaicu", 2006

Tema 5. Analiza economico-financiară a societății

Obiective specifice:

La finalul formării, cursanţii vor fi capabili să:

- **O.S.5.1**.- Descrie principalele metode de funcţionare a analizei economico-financiare prin explicarea şi interpretarea corelaţiilor dintre indicatorii economico-financiari;
- **O.S.5.2.**- Stabilească un diagnostic economico-financiar al unei entităţi economice prin utilizarea metodelor şi tehnicilor de diagnostic economico-financiar;

Nr. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
8	**4**	**4**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
60	30	Analiza elementelor de bilanţ	Definirea bilanțului contabil Prezentarea posturilor bilanțiere	- Explicația - exemplificarea - Discuţia - Prelegerea interactivă	Video proiector
60	120	Analiza echilibrului financiar	Evaluarea echilibrului financiar pe baza situației nete Prezentarea, calculul și interpretarea celor trei indicatori ai echilibrului financiar Analiza indicatorilor echilibrului financiar ținand cont de politica de echilibru financiar	- Exercițiul - Învăţarea prin cooperare	Video proiector
60	30	Analiza rentabilităţii	Stabilirea performanței întreprinderii pe baza contului de profit și pierdere Prezentarea veniturilor și cheltuielilor pe domenii de activitate	- Prelegerea interactivă - Studiul de caz	Video proiector
60	60	Capacitatea și efectul de îndatorare	Prezentarea, calculul și interpretarea indicatorilor referitori la capacitatea de îndatorare Stabilirea efectului de	- Prelegerea interactivă - Demonstrația - Învăţarea prin descoperire	Video proiector

			îndatorare ca urmare a folosirii capitalului împrumutat	- Învăţarea prin cooperare	

Rezumatul temei: Sesiunea de formare durează opt ore, patru ore de curs și patru de activități practice. Pe parcursul sesiunii vor fi prezentate patru teme de prezentare teoretică și de aplicații practice. În prima parte teoretică vor fi prezentate elementele de bilanț contabil. Prima parte aplicativă este dedicată prezentării posturilor bilanțiere și ordonarea acestora după lichiditate, respectiv exigibilitate. Partea a doua prezintă analiza echilibrului financiar al societății structurată în o oră de curs și două ore de activități practice. În partea teoretică se prezintă indicatorii de echilibru financiar, iar în partea aplicativă se vor calcula și interpreta acești indicatori. În partea a treia teoretică sunt definite veniturile și cheltuielile societății prin prisma domeniilor de activitate iar la partea aplicativă discutii cu privire la rezultatul exercițiului în urma acțiunilor economice întreprinse. În partea de final a temei vor avea loc discuții referitoare la capacitatea și efectul de îndatorare. Capacitatea de îndatorare se exprimă prin intermediul a doi indicatori, aceștia fiind analizați la partea aplicativă, unde se va prezenta și efectul de îndatorare ca urmare a folosirii capitalului împrumutat.

Strategiile de formare utilizate

Pe parcursul temei 5 formatorii vor utiliza, cu precădere, următoarele strategii și metode de formare și de învățare:

- Demonstrația
- Explicația
- Exercițiul
- Discuţia
- Prelegerea interactivă
- Învăţarea prin descoperire
- Învăţarea prin cooperare

Strategia evaluării pe parcurs din cadrul temei 5

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității formabililor, în timpul destinat organizării față în față. În acest scop se va dialoga cu formabilii, li se vor adresa întrebări pentru a stabili cunoaşterea terminologiei specifice, capacitatea de utilizare a noţiunilor specifice și capacitatea de a utiliza cunoştinţele acumulate pentru conceperea și dezvoltarea unei afaceri

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Tema 6. Activitățile antreprenoriale și creșterea economică

Obiective specifice:

La finalul formării, cursanţii vor fi capabili să:

- O.S.6.1.- identifice segmentul de piață țintă prin cunoașterea caracteristicilor pieței, preferințelor consumatorilor și politica de preț;

r. de ore alocate			
Total	**Curs (C)**	**Seminar (S)**	**Evaluare (Ev)**
2	**2**	**-**	

Durata		**Conţinut**	**Activităţi**	**Metode utilizate**	**Resurse**
C	**Ap**				
60		Aplicarea creativității antreprenoriale în dezvoltarea activității	Definirea obiectivelor sau specificarea rezultatelor dorite în activitatea antreprenorială Identificarea situației actuale a organizației și analizarea alternativelor de dezvoltare	- Prelegerea interactivă	Video proiector
60		Utilizarea funcțiilor de planificare a managementului	Stabilirea obiectivelor organizației și ajustarea lor la nivelul realizabil Prezentarea avantajelor planificării în activitatea antreprenorială	- Prelegerea interactivă - Exercițiul	Video proiector

Rezumatul temei: Sesiunea de formare durează două ore de curs. Pe parcursul sesiunii vor fi prezentate două teme teoretice. În prima parte va fi prezentată activitatea de creativitate antreprenorială necesară pentru dezvoltarea activității. Creativitatea antreprenorială presupune cunoașterea firmei, a performanțelor, a vulnerabilităților și a noțiunilor generale de marketing și de management. În a doua parte se va discuta despre funcțiile managementului cu accent pe funcția de planificare, cea de antrenare și de organizare. În cadrul acestei teme vor fi prezentate resursele necesare pentru atingerea obiectivelor stabilite, precum și resursele disponibile activității antreprenoriale.

Strategiile de formare utilizate

Pe parcursul temei 6 formatorii vor utiliza, cu precădere, următoarele strategii și metode de formare și de învățare:

- Prelegerea interactivă
- Exercițiul

Strategia evaluării pe parcurs din cadrul temei 6

Evaluarea pe parcursul acestui modul se va realiza pe baza observării participării și a activității formabililor, în timpul destinat organizării față în față. În acest scop se va dialoga cu formabilii, li se vor adresa întrebări pentru a stabili cunoaşterea terminologiei specifice, capacitatea de utilizare a noţiunilor specifice și capacitatea de a utiliza cunoştinţele acumulate pentru conceperea și dezvoltarea unei afaceri

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Semnătura,