Syllabus

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Departament	Automation
1.4 Field of study	Systems Engineering
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Automation and Applied Informatics (English)
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	***Computer Integrated Manufacturing***			Discipline code	**54.20**
2.2 Course responsible/lecturer	*șl.dr.ing. Sorin HERLE – sorin.herle@aut.utcluj.ro*				
2.3 Teachers in charge of applications	*șl.dr.ing. Sorin HERLE – sorin.herle@aut.utcluj.ro*				
2.4 Year of study		2.5 Semester		2.6 Assessment *(E/C/V)*	E
2.7 Type of subject	*DF – fundamental, DS – specialty, DC – complementary*				DS
	DOB – compulsory, DOP – elective, DFA – optional				DOB

3. Estimated total time

3.1 Number of hours per week	5	of which:	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	3	3.3 Project	0
3.4 Number of hours per semester	70	of which:	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	42	3.6 Project	0
3.7 Individual study										
(a) Manual, lecture material and notes, bibliography										14
(b) Supplementary study in the library, online and in the field										10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										14
(d) Tutoring										14
(e) Exams and tests										3
(f) Other activities:										0

3.8 Total hours of individual study (sum of (3.3(a)…3.3(f)))	55
3.9 Total hours per semester (3.2+3.4)	125
3.10 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	Robot control systems, Electric and electronic control equipment, Hydro-pneumatic control equipment
4.2 Competence	Robots programming, PLCs programming

5. Requirements (where appropriate)

5.1. For the course	The tests at the end of the courses may only be taken by participants who have attended the course from the beginning. Attendance at the courses is not mandatory.
5.2. For the applications	The laboratory activities are mandatory

6. Specific competences

Professional competences	C3 Use the fundamentals of automatic control, as well as methods for modeling, simulation, identification, and analysis of processes, together with computer-aided design (CAD) techniques. C3.2 Explain and interpret automation problems for various types of processes by applying the fundamentals of automatic control, methods for modeling, identification, simulation, and process analysis, as well as computer-aided design techniques. C3.5 Configure and implement control systems for industrial processes, robots, and flexible manufacturing lines, including the selection of appropriate equipment, system tuning, and commissioning of the corresponding control structures. C5 Develop applications and implement automatic control algorithms and control structures using project management principles, programming environments, and technologies based on microcontrollers, signal processors, programmable logic controllers (PLCs), and embedded systems. C5.1 Identify concepts, development methods, and programming languages specific to application development (sequential, concurrent, real-time, non-real-time, local, distributed, embedded, non-embedded, mobile, online, etc.) and project management. C5.2 Explain and interpret the correspondence between a system design and its real-world implementation by applying the fundamental principles and methods for designing and implementing automatic control algorithms and system architectures, including embedded or distributed systems based on microcontrollers, signal processors, programmable logic controllers (PLCs), and related technologies. C5.4 Evaluate the implementation of automation and software applications using automatic control algorithms and structures, programming environments, and technologies based on microcontrollers, signal processors, programmable logic controllers (PLCs), embedded systems, and related platforms.
Cross competences	N/A

7. Expected learning outcomes

Knowledge	Describe, identify, and summarize concepts, methods, and structures specific to the programming of equipment used in an integrated manufacturing system, including: • Fundamental concepts related to the operation of equipment within a flexible manufacturing system. • Programming of equipment used in an integrated manufacturing system (e.g., industrial robots, programmable logic controllers (PLCs), etc.). • The structure of programs for industrial robots and programmable logic controllers (PLCs). • Development of graphical user interfaces (GUIs) for applications in the field of computer-integrated manufacturing (CIM). • Use of simulation environments for developing, testing, and validating programs for equipment within a manufacturing system.
Skills	• Select and apply techniques specific to the programming of equipment used in an integrated manufacturing system. • Design, implement, and test applications for equipment within a manufacturing system using dedicated software environments. • Develop practical applications for manufacturing cells using specialized hardware and software platforms. • Use simulation and programming tools to implement, verify, and validate programs for equipment used in an integrated manufacturing system.
Responsibilities and autonomy	• Demonstrate professional responsibility and adhere to ethical principles in the development of programs for equipment used in manufacturing systems. • Apply safety regulations and best practices in the operation of manufacturing system equipment, including industrial robots, automated storage systems, conveyors, and related equipment. • Work independently and collaboratively in the development and integration of manufacturing applications. • Demonstrate autonomy in the design and implementation of programs for industrial robots, automated storage systems, material handling systems, and related equipment. • Adopt an innovation-oriented mindset, pursue continuous professional development, and use modern technologies responsibly.

8. Course objectives

General objective	Develop competencies in the programming of equipment used in integrated manufacturing systems.
Specific objectives	Acquire theoretical knowledge related to the programming of industrial robots, programmable logic controllers (PLCs), and other equipment used in integrated manufacturing systems. Develop practical skills for designing and implementing control programs for equipment within integrated manufacturing systems.

9. Contents

9.1 Lecture	No.hours	Teaching methods	Notes
Introduction in Manufacturing	2	Multimedia presentations. Lectures using the whiteboard and marker (or blackboard and chalk), followed by discussions. Quizzes	In the event of force majeure, classes will be conducted online via the Microsoft Teams platform.
Manufacturing Systems	2		
Manufacturing Operations	2		
Material handling systems	2		
Automatic data capture	2		
Group technology	2		
Flexible manufacturing systems	2		
Concurrent engineering and process planning	2		
Production planning systems	2		
Production control systems	2		
Quality in manufacturing	2		
Sustainable manufacturing	2		
Revolution and evolution in manufacturing	2		
Production systems - recapitulative course	2		

Bibliography

1.Sorin HERLE, Computer integrated manufacturing - Lecture notes - 2027, (on-line: http://rocon.utcluj.ro/sorin/CIMc.html);
2.Mikell P. Groover, Automation, Production Systems, and Computer Integrated Manufacturing (4th edition), Prentice Hall 2016;
3.James A. Rehg, Henry W. Kraebber, Computer-Integrated Manufacturing (3rd edition), Prentice Hall 2005;
4.U. Rembold, B.O. Nnaji, A. Storr, Computer Integrated Manufacturing and Engineering , Addison-Wesley 1993;
5.Masaaki Imai , Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy 2/E –, Hardcover: 448 pages, Publisher: McGraw-Hill Professional; 2 edition (May 23, 2012), ISBN-10: 9780071790352, ISBN-13: 978-0071790352;
6.F. Robert Jacobs, Manufacturing Planning and Control for Supply Chain Management , William Berry (Author), D. Clay Whybark (Author), Thomas Vollmann (Author), Hardcover: 576 pages, Publisher: McGraw-Hill Professional; 1 edition (March 29, 2011), Language: English, ISBN-10: 0071750312, ISBN-13: 978-0071750318;
7.Steven M. Bragg, Inventory Management, 246 pages, Publisher: Accounting Tools (October 4, 2013), Language: English, ISBN-10: 1938910192, ISBN-13: 978-1938910197;
8.Larry Webber, Michael Wallace, Quality Control for Dummies, 384 pages, Publisher: For Dummies; 1 edition (2007), Language: English, ISBN-10: 0470069090, ISBN-13: 978-0470069097.

9.2 Aplications (seminar/laboratory**/project/practical work)	No.hours	Teaching methods	Notes
Modeling and simulation of a production line	3	Use of computers and equipment to test example applications and solve the proposed applications.	Software used: • Logixpro, • CX-Programmer, • RSLogixPro, • ACL, • LLWin, • Excel, • Arena, • Flexim, • MelfaMasic II, • Scorbot, • Step7, • CirosProduction.
Planning processes and production	3		
Flexible manufacturing system. Development and operation	3		
Programming of a dosing system	3		
The control of a mixing and thermal treatment plant	3		
Control of a bottling line	3		
Performance analysis of a manufacturing system	3		
Optimization of production processes	3		
User interfaces for production processes	3		
Programming of a transport and storage system	3		
Programming the scora-er 14pro robot	3		

Programming the scorbot-er 4u robot for sorting operations	3		Equipment used: Allen-Bradley SLC 500 PLC Omron CQM1 and CPM2A PLCs Siemens S3 PLC Fischertechnik RTT Robot Intelitek SCORA-ER 14 Pro Robot Intelitek SCORBOT-ER 4U Robot Mitsubishi RV-II AJ Robot
Programming a robotic handling system	3		
Programming a robotic assembly station	3		
** Each student will choose 12 of the 14 proposed laboratories.			
Bibliography 1. Sorin HERLE, Computer integrated manufacturing, UTPress, ISBN 978-606-737-222-9, 2017; 2. Sorin HERLE, Computer integrated manufacturing, 2027 (on-line: http://rocon.utcluj.ro/sorin/CIMl.html);			

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

Skills gained from participating in this discipline will be required engineers dealing with production planning and management, maintenance, manufacturing systems, quality control in production systems, manufacturing control systems, etc.

11. Evaluation

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade
11.4 Course	Assessment of the ability to understand the theoretical concepts presented. Assessment of the ability to apply the concepts presented to solve practical problems.	Written examination consisting of theoretical questions and problem-solving tasks, or tests administered at the end of each course. Upon request, the average score of the course tests may replace the final examination, provided that at least 50% of the maximum possible points have been earned (140 points, or fewer depending on the number of tests administered during the semester).	50%
11.5 seminar/ laboratory/ project/ practical work	Assessment of the ability to apply theoretical concepts in practice.	Assessment at the end of each laboratory session according to the grading rubric attached to each laboratory assignment and/or a laboratory colloquium at the end of the semester.	50%
11.6 Minimum performance standard A minimum grade of 5 is required on the final examination. A minimum grade of 5 is required for each laboratory assignment.			

Date of filling in:		Title Firstname NAME	Signature
07.07.2026	Course	sl.dr.ing. Sorin HERLE	
	Aplications	sl.dr.ing. Sorin HERLE	

Date of approval by the Department Board	Head of Departament Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council	Dean Prof.dr.ing. Vlad MUREȘAN