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	***Digital Control of Machine - Tools***			Discipline code	**54.10**
2.2 Course responsible/lecturer	*ș.l.dr.ing. Sorin HERLE – sorin.herle@aut.utcluj.ro*				
2.3 Teachers in charge of applications	*ș.l.dr.ing. Sorin HERLE – sorin.herle@aut.utcluj.ro*				
2.4 Year of study	4	2.5 Semester	2	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, CAD in automation
4.2 Competence	CAD

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	**C1** Use of knowledge in mathematics, physics, measurement techniques, technical drawing, mechanical engineering, chemistry, electrical engineering, and electronics in systems engineering. **C1.3** Solving common problems in the field of systems engineering by identifying appropriate techniques, principles, and methods, and by applying mathematics, with an emphasis on numerical computation methods. **C5** Development of applications and implementation of 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** Identification of 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. **C5.3** Selection of technologies and equipment appropriate to the intended purpose of automated systems, software applications, and operating conditions.
Cross competences	N/A

7. Expected learning outcomes

Knowledge	Describe, identify, and summarize concepts, methods, and structures specific to CNC (Computer Numerical Control) machine programming, including: • Fundamental concepts of CNC machining. • The codes used to create programs for CNC machines. • Technological parameters and their importance in developing CNC programs. • The structure of a CNC program and its specific characteristics depending on the type of machine. • Programming principles specific to CNC machines. • The use of simulation environments for CNC program verification and validation.
Skills	• Select and apply methods specific to CNC (Computer Numerical Control) machine programming. • Design, implement, and test applications for CNC machines using dedicated software environments. • Apply computational methods to solve problems related to the definition and generation of toolpaths for CNC machines. • Develop practical applications for CNC milling machines and lathes using specialized hardware and software platforms. • Use programming and simulation tools to implement, verify, and validate CNC machine programs.
Responsibilities and autonomy	• Demonstrate professional responsibility and adhere to ethical principles in the development of CNC (Computer Numerical Control) machine programs. • Apply safety regulations and best practices in the operation of CNC machines. • Work independently and collaboratively in the development and integration of CNC applications. • Demonstrate autonomy in the design and implementation of CNC machine programs. • Adopt an innovation-oriented mindset, pursue continuous professional development, and use modern technologies responsibly.

8. Course objectives

General objective	Developing skills in CNC machines field.
Specific objectives	The assimilation of specific theoretical knowledge of materials processing using CNC machines. Developing skills in programming CNC machines.

9. Contents

9.1 Lecture	No.hours	Teaching methods	Notes
Introduction to CNC machine tools	2	Multimedia presentations. Lectures using the whiteboard and marker (or	In the event of force majeure, classes will be
Basics of CNC programming	2		
Programming the linear trajectories	2		
Programming the circular trajectories	2		
Programming the milling operations	2		

Programming the pocket milling operations	2	blackboard and chalk), followed by discussions. Quizzes	conducted online via the Microsoft Teams platform.
Programming the drilling operations	2		
Programming the milling cycles. Part I	2		
Programming the milling cycles. Part II	2		
Turning operations	2		
Programamming the turning operations	2		
Programming the turning cycles	2		
CAD-CAM systems	2		
Summary of the course	2		
Bibliography 1. Sorin Herle, Digital Control of Machine Tools, lecture notes, 2027, http://rocon.utcluj.ro/sorin/DCMTc.html 2. Peter Smid, CNC Tips and Techniques: CNC Tips and Techniques, 200 pages, Publisher: Industrial Press (February 15, 2013), Language: English, ISBN-10: 0831134720, ISBN-13: 978-083113472; 3. Peter Smid, CNC Programming Techniques: An Insider's Guide to Effective Methods and Applications, Industrial Press 2005; 4. Peter Smid, CNC Programming Handbook, Third Edition [Hardcover], 600 pages, Publisher: Industrial Press, Inc.; 3 edition (November 26, 2007), Language: English, ISBN-10: 0831133473, ISBN-13: 978-0831133474			
9.2 Aplications (seminar/laboratory**/project/practical work)	No.hours	Teaching methods	Notes
The use of EXSL-WIN software for programming of CNC machines	3	Use of computers to test example applications and solve the proposed applications.	Software used: • EXSL-WIN • CADEM CapsMill • CADEM CapsTurn
Programming linear movements for a milling machine	3		
Programming circular movements for a milling machine	3		
Programming face milling and end milling operations	3		
Programming pocket milling	3		
Programming drilling operations on a milling machine	3		
Programming milling operations using cycles. Part I	3		
Programming milling operations using cycles. Part II	3		
Programming turning operations	3		
Programming turning operations using cycles	3		
Programming using Caps Mill CAD-CAM software	3		
Programming using Caps Turn CAD-CAM software	3		
Programming of PC F020 milling machine	3		
Programming of CH-A01 milling machine	3		
** Each student will choose 12 of the 14 proposed laboratories.			
Bibliography 1. Sorin HERLE, Digital control of machine tools, UTPress, ISBN 978-606-737-223-6, 2017; 2. Sorin HERLE, Digital control of machine tools, 2027 (on-line: http://rocon.utcluj.ro/sorin/DCMTl.html);			

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

The competencies acquired through this course will be valuable for engineers involved in CNC (Computer Numerical Control) machine programming.

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/	Assessment of the ability to apply theoretical	Assessment at the end of each laboratory session according to the grading rubric attached to each	50%

project/ practical work	concepts in practice.	laboratory assignment and/or a laboratory colloquium at the end of the semester.	
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