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
1.8 Codul disciplinei	47.00

2. Data about the subject

2.1 Subject name	*Robot Control systems*					
2.2 Course responsible/lecturer	ŞL. dr. Ing Anastasios NATSAKIS – tassos.natsakis@aut.utcluj.ro					
2.3 Teachers in charge of applications						
2.4 Year of study	4	2.5 Semester	1	2.6 Assessment *(E/C/V)*		E
2.7 Type of subject	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*					DD
	DI – compulsory, DO – elective, Dfac – optional					DI

3. Estimated total time

3.1 Number of hours per week	5	of which:	Course	2	Seminar	0	Laboratory	2	Project	1
3.2 Number of hours per semester	130	of which:	Course	28	Seminar	0	Laboratory	28	Project	14

3.3 Individual study	
(a) Manual, lecture material and notes, bibliography	28
(b) Supplementary study in the library, online and in the field	14
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(d) Tutoring	2
(e) Exams and tests	2
(f) Other activities:	0

3.4 Total hours of individual study (sum of (3.3(a)…3.3(f)))	60
3.5 Total hours per semester (3.2+3.4)	130
3.6 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	Systems Theory, Process modeling, Linear Algebra and Analytical Geometry, Python programming
4.2 Competence	Solve problems in the field of systems engineering by identifying proper methods and techniques applying mathematics and numerical calculus

5. Requirements (where appropriate)

5.1. For the course	N/A
5.2. For the applications	Presence is mandatory

6. Specific competences

6.1 Professional competences	C3 Operating with fundamentals of control engineering, process modelling, simulation, identification and analysis methods, and computer aided design.
6.2 Cross competences	

7. Course objectives

7.1 General objective	Acquire knowledge in design, programming and operating industrial robots.
7.2 Specific objectives	Industrial robots modelling, Robot control algorithms, Robot programming,

	Industrial applications	

8. Contents

8.1 Lecture	No. hours	Teaching methods	Notes
Homogeneous transformations	2		
Forward kinematics	2		
Denavit-Hartenberg convention	2		
Jacobian matrix	2		
Inverse kinematics	2		
Trajectories	2	Presentation, Examples, Practical applications	
Dynamic modeling	6		
Control strategies	2		
Mobile robots	2		
Drones	2		
Underwater robots	2		
Applications	2		
Bibliography 1. Philip J.Mc.Kerrow – Introduction to Robotics – Addison-Weslwy Publ.Co.,1995. 2. John J.Craig – Introduction to Robotics (Mechanics and Control) – CRC Press 2005. 3. Lazea Gh.,E.Lupu, P.Dobra- Sisteme de conducere a robotilor si fabricatie integrata. Ed.Mediamira, 1998. 4. Mark W. Spong - Robot modeling and control – John Willey & Sons, 2004. 5. Shuai Li - Kinematic Control of Redundant Robot Arms Using Neural Networks, 2019.			
8.2 Applications (laboratory)	No. hours	Teaching methods	Notes
Homogeneous transformations	2		
Forward kinematics	2		
Denavit-Hartenberg convention	2		
Jacobian matrix	2		
Inverse kinematics	2		
Trajectories	2	Practical applications, numerical methods	
Dynamic modeling	6		
Individual joint control	2		
Computed torque control	2		
Drones modeling	2		
Underwater robots	2		
Applications	2		
Bibliography 1. Philip J.Mc.Kerrow – Introduction to Robotics – Addison-Weslwy Publ.Co.,1995. 2. John J.Craig – Introduction to Robotics (Mechanics and Control) – CRC Press 2005. 3. Lazea Gh.,E.Lupu, P.Dobra- Sisteme de conducere a robotilor si fabricatie integrata. Ed.Mediamira, 1998. 4. Mark W. Spong - Robot modeling and control – John Willey & Sons, 2004 5. Peter Corke – Robotics toolbox for python			
8.3 Applications (project)	No. hours	Teaching methods	Notes
Understanding ROS filesystem	2		
Creating basic applications	4	Practical applications, numerical methods	
Setting up a robotic platform	2		
Develop a robotic application	4		
Reporting	2		
Bibliography 1. Ramkumar Gandhinathan - ROS Robotics Projects – Packt publishing, Dec 2019			

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

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10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Demonstration of understanding of principles of robotic structures, modeling, control and applications	Written examination	60%
Laboratory	Ability to construct robotic simulations and design controller strategies	Computer examination	30%
Project	Ability to construct basic robotic simulations using ROS	Report	10%
Minimum standard of performance: Final mark (course, laboratory, and project) ≥ 5			

Date of filling in: 27.06.2022		Title First name NAME	Signature
	Course	ŞlL dr. Ing. Anastasios NATSAKIS	
	Applications		

Date of approval by the Department Board ……..	Head of Departament ……. Prof.dr.ing. Honoriu VĂLEAN
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Date of approval by the Faculty Council ……………	Dean Prof.dr.ing. Liviu Cristian MICLEA
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