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	ȘL. dr. Ing Anastasios NATSAKIS – tassos.natsakis@aut.utcluj.ro				
2.3 Teachers in charge of applications	ȘL dr. Ing. Anastasios NATSAKIS – tassos.natsakis@aut.utcluj.ro				
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
Introduction to Robotis	2	Presentation, Examples, Practical applications	
Forward kinematics – Homogeneous Transformations	2		
Forward kinematics - Denavit-Hartenberg convention	2		
Jacobian matrix	2		
Inverse kinematics	2		
Dynamic modeling	2		
Introduction to industrial robots programming	2		
Programming and Control of robots	8		
Other types of robots (mobile, drones, underwater	6		
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
Coordinate systems	2	Practical applications, numerical methods	
Forward kinematics	2		
Denavit-Hartenberg convention	2		
Inverse kinematics	2		
Dynamic modeling	4		
Control design for industrial robots	4		
Industrial robots programming	4		
Applications for object manipulation	2		
Applications on other robot types	4		
Evaluation	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
Topic choice	1	Practical applications, numerical methods	
Model implementation for selected topic	8		
Interface creation and control methodology for selected topic	4		
Reporting and presentation	1		
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

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:		**Title First name NAME**	**Signature**
30.03.2023	Course	Ș.L dr. Ing. Anastasios NATSAKIS	
	Applications	Ș.L dr. Ing. Anastasios NATSAKIS	

Date of approval by the Department Board ……..

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Head of Departament .....
Prof.dr.ing. Honoriu VĂLEAN

Date of approval by the Faculty Council ……

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Dean
Prof.dr.ing. Liviu Cristian MICLEA