SYLLABUS SHEET

1. Data about study program

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 School	Industrial Engineering, Robotics, and Management of Production
1.3 Department	Design Engineering and Robotics
1.4 Field of study	Mechatronics and Robotics
1.5 Study cycle	Master
1.6 Study program	Robotics
1.7 Learning format	Full-time learning
1.8 Course unit code	1.00

2. Data about course unit

2.1 Course unit title			Programming Language of Industrial Robots		
2.2 Course responsible			Prof. dr. eng. Stelian Brad stelian.brad@staff.utcluj.ro		
2.3 Lab responsible			Prof. dr. eng. Stelian Brad stelian.brad@staff.utcluj.ro		
2.4 Year of study	1	2.5 Semester	1	2.6 Type of examination	EX
2.7 Course unit category	Formative				X
	Optional				

3. Total estimated duration

3.1 No. hrs/week	4	From which:	3.2 Course	2	3.3 Seminar	0	3.3 Lab	2	3.3 Project	0
3.4 No. hrs / semester	56	From which:	3.5 Course	28	3.6 Seminar	0	3.6 Lab	28	3.6 Project	0

3.7 Time distribution per semester:	
(a) Study based on notes, bibliography, course manuscripts	14
(b) Additional documentation in the library, Internet, in the field	10
(c) Preparation of lab work	26
(d) Tutorship	0
(e) Examinations	4
(f) Other activities	0
3.8 Total individual study (sum (3.7(a)...3.7(f)))	44
3.9 Total semester (3.4+3.8)	100
3.10 ECTS	4

4. Prerequisite

4.1 Curriculum	N/A
4.2 Competences	BSc graduate in engineering

5. Conditions

5.1. to run the course unit	Access to Internet; access to RobotStudio platform; Access to a computer for each student; MS PowerPoint; MM Projector
5.2. to run the applications	Access to Internet; access to RobotStudio platform; Access to a computer for each student; MS PowerPoint; MM Projector

6. Specific skills

Professional skills	• To plan and design a programming application in a programming language specific to industrial robots • To know instructions, functions, data, data types for RAPID programming language • To write and test applications for industrial robots in RAPID • To evaluate in a critical, qualitative, and quantitative mode specific robot applications • To program ABB industrial robots • To develop professional projects for industrial robots
Transversal skills	• To apply ethics in engineering • To perform professional tasks in a responsible manner, in autonomous way, and professional independence • To promote logical reasoning • To schedule and plan working priorities • Self-control

7. Course unit objectives

7.1 General objective	Develop skills to plan, analyse, build, integrate robot applications in an advanced programming language dedicated to industrial robots
7.2 Specific objectives	- Use at expert level the RAPID programming language - Develop robot applications for the top industrial use cases - Develop logical thought, critical analysis, individual study, self-assessment

8. Contents

8.1 Topic	No. hrs	Teaching methods	Remarks
Introduction in industrial robot programming	2	Theory; Examples; Q&A; Self-assessment; Individual exercises	
Structure of RAPID programming language	2		
Declarations, expressions, operators in RAPID	2		
Data types and data structures in RAPID – part I	2		
Data types and data structures in RAPID – part II	2		
Instructions in RAPID – part I	2		
Instructions in RAPID – part II	2		
Instructions in RAPID – part III	2		
Functions in RAPID	2		
Error handling in RAPID – part I	2		
Error handling in RAPID – part II	2		
Multi-tasking programming in RAPID	2		
Communication with external axis	2		
Comparative analysis of various programming languages of industrial robots	2		
Bibliography: Notes in electronic format Manual of RAPID programming language			
8.2 Labs	No. hrs	Teaching methods	Remarks
Console, installing the IDE, robot handling from console, interfacing with computer, user interface, TCP record	2	Interactive onsite teaching: exemplification – verification of progress – additional explanations	
Connection with external axes, real and simulated signals, build an application (no code, only declarations)	2		
Event manager, mechanism design, programming a robot assembly application	2		
Test control flow instructions, data declaration, programming an arc welding robot application	2		

Importing code in RAPID from an external editor, creation of user-defined instructions, data declaration, programming a spot-welding robot application	2		
Test some moving instructions, test some instructions for user interface, test some instructions to operate with signals, programming a spray-painting robot application	2		
Test some instructions to work with signals, programming a robot application for contouring (e.g. gluing)	2		
Test some instructions with external axes, programming a robot application for deburring and interaction with external axes	2		
Test some instruction for working with files and I/O units, test some functions, programming a robot application for laser cutting on 3D paths	2		
Test some instructions for error handling, programming a robot application for metal sheet bending	2		
Test some instructions for error handling, create smart components for virtual commissioning, programming a robot application for handling and assembly with more robots	2		
Test some synchronizing instructions, programming a multi-tasking robot application for arc welding	2		
Programming a client-server application robot-robot, programming a client-server application computer-robot	2		
Comparative analysis of a robot application in RAPID-KRL-KAREL-INFORM-UR Script-VAL3, etc.	2		
Bibliography: Lab materials in electronic format Manual of RAPID programming language Online materials			

9. Corroboration with other elements

Hands on course unit. Learn technologies applied in Romania and EU. Use cases from industry. Real life applications.

10. Evaluation

Type activity	10.1 Evaluation criteria	10.2 Assessment	10.3 Distribution
10.4 Course	Completeness of problem Quality of code	Use course materials M1. Test 4 hrs to solve 2 problems on computer M2. Assessment of individual exercises	50% 10%
10.5 Lab	Complexity of application Completeness of problem Quality of code	Student can choose a problem for a list with various degrees of complexity – from 6 to 10 M3. Intermediary test 1 M4. Intermediary test 2	 20% 20%
10.6 Minimum standard M1. Problem 1 – coding min. 30% of the functional requirements M1. Problem 2 – coding min. 30% of the functional requirements M2. Min. 5 individual exercises completed			

M3. Problem of complexity 1 – 70% completed; Problem of complexity 2 – 60% completed; Problem of complexity 3 – 50% completed; Problem of complexity 4 – 40% completed; Problem of complexity 5 – 30% completed.
M4. Problem of complexity 1 – 70% completed; Problem of complexity 2 – 60% completed; Problem of complexity 3 – 50% completed; Problem of complexity 4 – 40% completed; Problem of complexity 5 – 30% completed.

Date:	**Chair**	**Title Name SURNAME**	**Signature**
	Course	Prof. dr. eng. Stelian BRAD	
	Applications	Prof. dr. eng. Stelian BRAD	

Date approval Council of Dept. IPR

_____

Head of Department
Prof. dr. eng. Călin NEAMȚU

Date approval Council of IERMP School

_____

Dean
Prof. dr. eng. Stelian BRAD

SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Machine Building
1.3 Department	Design Engineering and Robotics
1.4 Field of study	Mechatronics and Robotics
1.5 Cycle of study	Master of science
1.6 Program of study / Qualification	Robotics / Mechanical engineer
1.7 Form of education	FT – Full time
1.8 Subject code	2.00

2. Data about the subject

2.1 Subject name			Computer aided robotization		
2.2 Course responsible			Lect. eng. Ștefan BODI, Ph.D. – stefan.bodi@muri.utcluj.ro		
2.3 Seminar / **Laboratory applications** / Project applications responsible			Lect. eng. Ștefan BODI, Ph.D. – stefan.bodi@muri.utcluj.ro		
2.4 Year of study	1	2.5 Semester	1	2.6 Method of assessment	E
2.7 Subject	Category				DA
	Type				DI

3. Estimated total time

3.1 Number of hours per week	2	of which:	3.2 Course	1	3.3 Seminars	0	3.3 Laboratory	1	3.3 Project	0
3.4 Number of hours per semester	28	of which:	3.5 Course	14	3.6 Seminars	0	3.6 Laboratory	14	3.6 Project	0

3.7 Distribution of time (hours per semester) for:	
(a) Study after the textbook, course support, bibliography, and course notes	16
(b) Supplementary study in the library, on specialty electronic platforms and in the field	18
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	10
(e) Exams and tests	8
(f) Other activities:	
3.8 Total hours of individual study (sum of (3.7(a)…3.7(f))	72
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 of curriculum	Knowledge of basic commands in the DELMIA V5-6 software program
4.2 of competences	It is not necessary

5. Requirements (where appropriate)

5.1. for the course	N/A
5.2. for the seminar / laboratory applications / project applications	The attendance to the laboratory applications is required.

6. Specific competences

Professional competences	
Cross competences	

7. Subject objectives (as result from the key competency grid)

7.1 General objective	Deepening the theoretical and practical knowledge related to the modeling and simulation of automated and semi-automated (robotic) manufacturing processes, using dedicated software solutions, and improving their operation by following the technological flow in detail.
7.2 Specific objectives	Students learn the following aspects: - design of high-complexity automated manufacturing systems, using CATIA V5-6 and DELMIA V5-6 software solutions; - simulation of the operation of various welding equipment (spot and electric arc) in an industrial manufacturing scenario; - simulation of the operation of collaborative robots (robots); - simulation of the operation of a flexible manufacturing cell.

8. Contents

8.1 Course	No. of h	Teaching methods	Notes
New production systems adapted to the Industry 4.0 concept	2	- Presentations with media/video support; - Case studies and exercises; - Q&A session; - Online teaching scenario on Microsoft Teams, according to the TUCN senate decision no. 1226/10.09.2020	
Overview of the DELMIA V5-6 software package	2		
Simulation of a flexible manufacturing cell using DELMIA V5-6	2		
Analysis and optimization of production systems using DELMIA V5-6	2		
DELMIA V5-6: Spot welding module	2		
DELMIA V5-6: Arc welding module	2		
Simulation of human activities in a flexible manufacturing system using DELMIA V5-6	2		

Bibliography:

1. Neamțu Călin, Popescu Daniela, Popișter Florin, Module CAD/CAM in Catia V5, ISBN 978-606-543-361-8, Mega Publishing, Cluj-Napoca, 2013.
2. The official courses of CATIA, DELMIA developed by Dassault Systemes, provided through the Dassault Systemes Resource Center and the 3DSAcademy platform.

Internet resources:

1. https://www.3ds.com/
2. https://edu.3ds.com/en/students

Other:

1. Course notes

8.2 Seminars / **laboratory applications** / project applications	No. of h	Teaching methods	Notes
Process Definition	2	- Practical exercises - Simulations and their analysis - Use of IT&C elements - Online teaching scenario on Microsoft Teams, according to the TUCN senate decision no. 1226/10.09.2020	
Process and resources definition	2		
Device Building	2		
Arc welding	2		
Workcell sequencing	2		
Production System analysis	2		
Digital process for Manufacturing	2		
Bibliography: 1. Neamțu Călin, Popescu Daniela, Popișter Florin, Module CAD/CAM in Catia V5, ISBN 978-606-543-361-8, Mega Publishing, Cluj-Napoca, 2013. 2. The official courses of CATIA, DELMIA developed by Dassault Systemes, provided through the Dassault Systemes Resource Center and the 3DSAcademy platform. 3. DELMIA and CATIA Companion.			

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

Industry 4.0 is a concept that nowadays has become a reality, being put into practice by most of the largest companies. Virtual manufacturing is a fundamental concept for Industry 4.0 and provides students with the basics for understanding the concept other connected aspects related to it. Advanced simulation of integrated human-robot systems is a key element of Industry 4.0.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The degree of understanding of the notions presented in the course is evaluated.	The exam consists of verifying the skills acquired through a written exam. The use of any documentation is permitted (C).	75%
10.5 Seminar /**Laboratory appl.** /Project appl.	Class activity during the semester. Submitted homework.	Laboratory grade (L)	25%
10.6 Minimum standard of performance • E = 3/4 * C + 1/4 * L. Condition for obtaining the credits: E≥5; C≥5; L≥5;			

Date of filling in:	**Responsible**	**Title First name LAST NAME**	**Signature**
	Course	Lect. eng. Ștefan BODI, Ph.D.	
	Applications	Lect. eng. Ștefan BODI, Ph.D.	

Date of approval in the department council _____	Head of department, Prof. eng. Călin NEAMȚU, Ph.D.
Date of approval in the faculty council _____	Dean, Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Industrial Engineering, Robotics, and Management of Production
1.3	Department	Mechanical Systems Engineering
1.4	Field of study	Robotics and Mechatronics
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Manufacturing Engineering/engineer
1.7	Form of education	Full time
1.8	Subject code	2300510

2. Data about the subject

2.1	Subject name			Object Oriented Programming Languages			
2.2	Subject area			Computer Programming (DAP, DCA)			
2.3	Course responsible/lecturer			Prof. dr. ing. ANTAL Tiberiu Alexandru – antaljr@bavaria.utcluj.ro			
2.4	Teachers in charge of seminars			Prof. dr. ing. ANTAL Tiberiu Alexandru			
2.5 Year of study	1	2.6 Semester	1	2.7 Assessment	C	2.8 Subject category	F/DA

3. Estimated total time

3.1 Number of hours per week	3	3.2 of which, course:	1	3.3 applications:	2
3.4 Total hours in the curriculum	42	3.5 of which, course:	14	3.6 applications:	28
Individual study					hours
Manual, lecture material and notes, bibliography					23
Supplementary study in the library, online and in the field					5
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					5
Tutoring					0
Exams and tests					3
Other activities					

3.7	Total hours of individual study	36
3.8	Total hours per semester	78
3.9	Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	Basic algorithm knowledges; some imperative programming language (C, C++, Java, Pascal) experience.
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	Attendance at the laboratory is mandatory.

6. Specific competences

Professional competences	After completing the discipline students will be able to: • identify the type of Java application and the conditions under which it can be run; • use JDeveloper to create and test a Java application • program in Java: - a structured and object-oriented application; - scientific applications that have graphical interfaces; - applications that operate with files; - applications that operate with relational databases through SQL; - applications based on the client-server architecture.
Cross competences	Applying the values and ethics of the engineering profession and responsible execution of complex professional tasks in conditions of professional autonomy and independence. Promoting logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision making. Planning your own work priorities, drawing up your own action plan.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Development of human-robot communication applications, integration and use of intelligent systems for interfacing industrial robots with the working environment.
7.2	Specific objectives	1. Planning and designing program applications in object-oriented programming languages for the realization of communication applications and human-robot interfaces; knowledge of objective programming environments, of client-server specific concepts, instructions and architectures, operation with files, databases, creation of graphical interfaces; understanding and using the concepts, paradigms and models of artificial vision applied in robotics, selection and use of artificial vision systems in robotics. 2. Use of specific development environments for creating and testing client-server applications in communication and interface with industrial robots and robotic systems in general, use of image processing environments in robotics. 3. Integrated application of advanced software environments for the development of intelligent human-robot interfaces, including interfaces based on artificial vision. 4. Critical, quantitative and qualitative evaluation based on methods of analysis, planning and selection of solutions for intelligent interfacing of operators with robots or robots with the working environment. 5. Elaboration of professional and / or research projects for the realization of human-robot, robot-robot, robot-work environment communication interfaces.

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
1. Java History. Benefits. Running Java and JVM applications. JDK, Java packages and packages. Basic concepts. Convention. Compilation and running.	Use of TIC/blended learning resources, discussions, Internet.	Video projector, board and/or online meetings on Skype(or MS Teams)
2. Primitive and structured data types. Basic concepts of object-oriented programming.		
3. Data input and output. Arrays and Strings.		
4. Operators and operands. Priority.		
5. Program flow. Types of statements. Sequence and decision.		
6. Loops and jumps.		
7. Classes and objects: declaration, creation, encapsulation.		
8. Methods. Builders. Overload. this. Inheritance. Super.		
9. Polymorphism. Exceptions.		
10. 2D graphics.		
11. Graphical interface elements: Swing (controls and events).		
12. File input / output operations.		
13. JDBC. SQL. Manipulation of real-time databases (MS Access) in Java.		
14. Classes for networking. A lite client-server architecture.		

Bibliography

1. Ştefan Tanasă, Cristian Olaru, Ştefan Andrei, Java de la 0 la expert, Polirom, 2003, ISBN: 973-681-201-4.
2. Peter Norton, William Stanek, Ghid de programare în Java, Teora, 1997, ISBN: 973-601-719-2.
3. Herber Schild, Java 2 - The Complete Reference, Fourth Edition, Osborne, 2001, ISBN: 0-07-213084-9.
4. Deitel H.M., Deitel P. J., Java - How to programm, Fith Edition, Prentice Hall, 2003, ISBN: 0-13-120236-7.
5. http://www.detect.utcluj.ro/~antaljr/downloads.html
6. http://193.226.7.179/~antaljr/

8.2. Applications/Seminars	Teaching methods	Notes
1. The JDeveloper IDE. The steps of creating an application.	Use of TIC/blended learning resources, discussions, Internet.	Video projector, board and/or online meetings on Skype(or MS Teams)
2. Entering and displaying data in text and graphics mode. String type. Conversions to and from primitives to String. Creating swing applications from the JDeveloper IDE.		
3. Applications with the operators of: assignment, arithmetic, bitwise, relational and boolean. Promotion and type forcing for arithmetic operators.		
4. Applications with if,?:, And switch. Specific errors.		
5. Applications with while, do, for, break and continue. Specific errors.		
6. Applications with class, new, public, private, protected.		
7. Applications with arrays and strings.		
8. Application of inheritance and polymorphism.		

9. Abstract methods and exceptions in numerical calculation.		
10. 2D graphic primitives. Process simulation.		
11. JPanel, Layout, TextBox, CommandButton, Events; The graph of a function with the solutions of an equation.		
12. Applications with data processing stored files.		
13. Implementing an application that operates with an MS Access database.		
14. Implementing a client-server application (the server accepts multiple connections).		
Bibliography 1. Deitel H.M., Deitel P. J., Java - How to programm, Fith Edition, Prentice Hall, 2003, ISBN: 0-13-120236-7. 2. http://www.east.utcluj.ro/mb/mep/antal/downloads.html 3. http://193.226.7.179/~antaljr/		

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

Master's students can choose to apply their knowledge acquired in industry, in research or in expanding, through a doctoral school, the skills acquired when completing a doctorate. Regardless of their option, the acquired competencies will be necessary in case they will carry out their activity within the specialized robot companies or within the software companies oriented on the field of robot programming, respectively when completing the doctorate.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Verification of knowledge by solving problems presented at the course or designing a complex project in Java.	Written test - duration of evaluation 1 hours or presentation of the Java design.	60% or 80%
10.5 Applications	Realization of an application in a given time (1h) having at its disposal all the course and laboratory documentation. Presentation of the implementation JDeveloper design.	Practical test - duration 2 hours or explaining and showing the working implementation.	40% or 20%
10.6 Minimum standard of performance			
A theory problem in the course, an application problem and a problem that extends an example from the laboratory or design and implementation of a small Java project in JDeveloper.			

Date of filling in:		Title Surname Name	Signature
	Lecturer	Prof.dr.ing. ANTAL Tiberiu Alexandru	
	Teachers in charge of application	Prof.dr.ing. ANTAL Tiberiu Alexandru	

Date of approval in the department

Head of department
Prof.dr.ing. ANTAL Tiberiu Alexandru.

Date of approval in the faculty ……

Dean
Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Machine Building
1.3	Department	Mechanical Systems Engineering
1.4	Field of study	Robotics and Mechatronics
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Manufacturing Engineering/engineer
1.7	Form of education	Full time
1.8	Subject code	2300510

2. Data about the subject

2.1	Subject name			Web Programming Technologies			
2.2	Subject area			Computer Programming (DAP, DCA)			
2.3	Course responsible/lecturer			Prof. dr. ing. ANTAL Tiberiu Alexandru – antaljr@bavaria.utcluj.ro			
2.4	Teachers in charge of seminars			Prof. dr. ing. ANTAL Tiberiu Alexandru			
2.5 Year of study	1	2.6 Semester	1	2.7 Assessment	C	2.8 Subject category	F/DA

3. Estimated total time

3.1 Number of hours per week	3	3.2 of which, course:	1	3.3 applications:	2
3.4 Total hours in the curriculum	42	3.5 of which, course:	14	3.6 applications:	28
Individual study					hours
Manual, lecture material and notes, bibliography					23
Supplementary study in the library, online and in the field					5
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					5
Tutoring					0
Exams and tests					3
Other activities					

3.7	Total hours of individual study	36
3.8	Total hours per semester	78
3.9	Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	Not necessary.
4.2	Competence	Not necessary.

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	Attendance at the laboratory is mandatory.

6. Specific competences

Professional competences	After completing the course, students will be able to create static and dynamic web pages that can be linked to robots and databases using: • HTML language for creating static web pages with hyperlinks, frames and forms; • The Visual Basic Script programming language together with the control events to verify the correctness of the control content; • Client and Server objects in ASP for creating pages with dynamic content; • ADO technology for accessing a database's data in order to exploit databases over the Internet.
Cross competences	• Applying the values and ethics of the engineering profession and responsible execution of complex professional tasks in conditions of professional autonomy and independence. • Promoting logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision making. • Planning your own work priorities, drawing up your own action plan.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Development of human-robot communication applications, integration and use of intelligent systems for interfacing industrial robots with the working environment.
7.2	Specific objectives	- Planning and designing communication web applications and human-robot interfaces; knowledge of Web programming tools, specific client-server concepts, instructions and architectures, operation with files, databases, creation of graphical interfaces; understanding and using the concepts, paradigms and models of artificial vision applied in robotics, selection and use of artificial vision systems in robotics. - Use of specific development media for creating and testing client-server applications in communication and interface with industrial robots and robotic systems in general, use of image processing media in robotics - Integrated application of advanced software environments for the development of intelligent human-robot interfaces, including interfaces based on artificial vision - Critical, quantitative and qualitative evaluation based on methods of analysis, planning and selection of intelligent interface solutions for operators with robots or robots with the working environment - Elaboration of professional and / or research projects for the realization of human-robot, robot-robot, robot-work environment communication interfaces

8. Contents

8.1. Lecture (syllabus)	Teaching methods	Notes
1. What is ASP? From HTML to ASP. GGI. Advantages of ASP.	Use of	Video projector,

Other methods for creating dynamic web pages. When to use ASP and HTML together? Comparison of ASP and other Web application development technologies. What is a Script?	TIC/blended learning resources, discussions, Internet.	board and/or online meetings on Skype(or MS Teams)
2. Introduction to HTML. HTML syntax - bookmarks and attributes. The structure of an HTML document. Items: META, LINK, BODY.		
3. Text formatting. Text containers. List styles. Other items. Include images in HTML documents.		
4. Making hyperlinks. Anchor marking. Tables.		
5. Frame. Staff benefits. Disadvantages of staff. Ways to avoid staff. Forms. Defining a form. Input elements.		
6. VBScript programming language. Keywords. Variables. Subroutines and functions. VBScript operators. Branching instructions. Cycling instructions. Strings. The quest.		
7. VBScript class. Defining given members. Implementing class properties. Defining class events.		
8. Client objects. Insert the script into the web page. Use of event handling procedures for controls. Script object hierarchy. The Window object.		
9. Object of the Document. The Navigator object. Form object.		
10. Server objects. Request, Application, and Server objects;		
11. Access to ASP files.		
12. Sending and receiving e-mail.		
13. ADO. Access to data with ADO.		
14. Maintain status in ASP applications.		

Bibliography

1. ANTAL Tiberiu Alexandru, Proiectarea paginilor Web cu HTML, VBScript si ASP, Editura RISOPRINT, 2003, p.224, ISBN 973-656-361-8.
2. ANTAL Tiberiu Alexandru, Microsoft Access 97 şi 2000 în 14 cursuri, Editura Todesco, 2000, p. 299, ISBN 973-99779-6-0.
3. ANTAL Tiberiu Alexandru, Visual BASIC pentru ingineri, Editura RISOPRINT, 2003, p.244, ISBN 973-656-514-4.
4. http://www.east.utcluj.ro/mb/mep/antal/downloads.html

8.2. Applications/Seminars	Teaching methods	Notes
1. The stages of a web request. How the customer submits the request. Request processing by server. URL components. How the server responds to a request. The way the customer processes the answer. Processing ASP requests. How the server separates the Script from the content. How the server processes the script. Browser and ASP code.	Use of TIC/blended learning resources, discussions, Internet.	Video projector, board and/or online meetings on Skype(or MS Teams)
2. Introducing freeware applications: CofeeCup Tools.		
3. Applications with header styles, alignment, paragraph, preformatted text, lists. IMG marking. Placing images on the page. Text-to-own space around the image. Background images. Creating a Curriculum Vitae Web page.		
4. The <A HREF> <A NAME>, <TABLE>, <TR>, <TD>, <THEAD>, and		

<TFOOT>, <FRAMESET>, <FRAME> tags. Application - making a bilingual CV with three frames and animated GIFs.		
5. Forms - Submit button, Reset button, enter text in forms, select multiple options from multiple options via check buttons, select a single option from multiple options via radio buttons, select from lists, hidden controls.		
6. VBScript language - declaring variables, writing Sub and Function procedures. Instructions: If ... Then, Select ... Case, For ... Next, While ... Wend, Do ... While. Applications with arithmetic, comparison, concatenation, logic operators.		
7. String operations. Common functions for handling inherited Visual Basic strings. Search phrase.		
8. VBScript class application with Property Get definition, Property Let, class method creation, Initialize event, Finish event.		
9. Applications with Window object properties, Window object methods, Windows object events, Document object properties, Document object methods.		
10. Applications with the properties of the Form object, the transfer (submit) of the forms, the manipulation of the controls of a form.		
11. Applications with Request, Application, and Server objects.		
12. Applications with the FSO script object model.		
13. Applications with the CDO script object model for NTS.		
14.Cookies, QueryString, Session. Application with login and registration in an Access database.		
Bibliography 1. ANTAL Tiberiu Alexandru, Proiectarea paginilor Web cu HTML, VBScript si ASP, Editura RISOPRINT, 2003, p.224, ISBN 973-656-361-8. 2. ANTAL Tiberiu Alexandru, Microsoft Access 97 şi 2000 în 14 cursuri, Editura Todesco, 2000, p. 299, ISBN 973-99779-6-0. 3. ANTAL Tiberiu Alexandru, Visual BASIC pentru ingineri, Editura RISOPRINT, 2003, p.244, ISBN 973-656-514-4. 4. http://www.east.utcluj.ro/mb/mep/antal/downloads.html		

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

Master's students can choose to apply their knowledge acquired in industry, in research or in expanding, through a doctoral school, the skills acquired when completing a doctorate. Regardless of their option, the acquired competencies will be necessary in case they will carry out their activity within the specialized robot companies or within the software companies oriented on the field of robot programming, respectively when completing the doctorate.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the

			final grade
10.4 Course	Verification of knowledge by solving problems presented at the course or designing a complex project in Java.	Written test - duration of evaluation 1 hour.	30%
10.5 Applications	Realization of an application in an imposed time (1h) having at its disposal all the course and laboratory documentation. Presenting a home-made application.	Practical test - duration 3 hours.	70%
10.6 Minimum standard of performance			
A course theory problem, an application problem, and a problem that extends an example from the lab.			

Date of filling in:		**Title Surname Name**	**Signature**
	Lecturer	Prof.dr.ing. ANTAL Tiberiu Alexandru	
	Teachers in charge of application	Prof.dr.ing. ANTAL Tiberiu Alexandru	

Date of approval in the department	Head of department Prof.dr.ing. ANTAL Tiberiu Alexandru.
Date of approval in the faculty ……	Dean Prof. eng. Stelian BRAD, Ph.D.

COURSE SHEET (FIŞA DISCIPLINEI)

1. Data about the program

1.1 University	Technical University of Cluj Napoca
1.2 Faculty	Machine Building
1.3 Department	Design Engineering and Robotics
1.4 Field of study	Mechatronics and robotics
1.5 Study cycle	Master
1.6 Study program / Qualification	Robotics
1.7 Form of education	IF – full-time education
1.8 Discipline code	7.00

2. Discipline data

2.1 The name of the discipline			Logically programmable controllers programing		
2.2 Course holder			Profesor dr. ing. Rațiu Claudiu – Claudiu.RATIU@muri.utcluj.ro		
2.3 Holder of seminar / laboratory / project activities			Profesor dr. ing. Rațiu Claudiu – Claudiu.RATIU@muri.utcluj.ro		
2.4 Year of study	I	2.5 Semester	2	2.6 Type of evaluatiun	Ex
2.7 Discipline regime	Formative category				DA
	Opțional				DI

3. Estimate total time

3.1 Number of hours per week	4	from which:	3.2 Course	2	3.3 Laboratory	2	3.3 Project	0		
3.4 Number of hours per semester	56	from which:	3.5 Course	28	3.6 Laboratory	28	3.6 Project	0		

3.7 Distribution of time fund (hours per semester) for:	
(a) Study by textbook, course support, bibliography and notes:	20
(b) Additional documentation in the library, on specialized electronic platforms and in the field:	14
(c) Preparation of seminars / laboratories, homework, papers, portfolios and essay:	8
(d) Tutorial:	0
(e) reviews:	2
(f) Other activities:	0

3.8 Total individual study hours (summ (3.7(a)...3.7(f)))	44
3.9 Total hours per semester (3.4+3.8)	100
3.10 Credits	4

4. Prerequisites (where appropriate)

4.1 of curriculum	Electrical engineering and electrical machines. Electronics and automation, Basics of automatic systems, Mechanics.
4.2 of skills	Programming languages, English

5. Terms (where appropriate)

5.1. of the course	Amphitheater or classroom with video projector.

5.2. seminar / laboratory / project	Laboratory room equipped with computers, PLCs and specific stands. Mandatory laboratory attendance

6. Specific skills acquired

Professional skills	- The aim is for students to acquire the knowledge and skills regarding the functioning and role of controllers in modern industrial applications; -To elaborate diagrams and logical graphs based on the operating cyclograms of robots or machine tools; -Develop programs with medium complexity in Alpha (SMC) and Step7-Simatic (Siemens) programming environments -To correlate the information from this discipline with those acquired in other disciplines: electronics, automatic adjustment, sensor, electric and / or hydro-pneumatic actuators;
Transversal skills	After completing the discipline students will be able to: -To elaborate correctly the operating cyclograms of the robots based on the kinematic and dynamic characteristics of the movements to be commanded / controlled; -To choose correctly / optimally the type of controller starting from the identification of the number and the type of necessary inputs-outputs; -To be able to elaborate, modify, transfer programs to and from the controller; -To configure applications using sensors, buttons, motors (electric / pneumatic), programming interfaces;

7. Discipline objectives (based on the grid of specific skills acquired)

7.1 The general objective of the discipline	Understanding the specific concepts of digital design and automation of drive systems in general and robotics in particular.
7.2 Specific objectives	• Correct interpretation of electrical and technological diagrams of drive systems. • Ability to develop, calculate, operational diagrams and program development. • Ability to interface with control units and the ability to develop control programs.

8. Contents

8.1 Course	teaching methods	Remarks
1. VLS (visual logic software) programming environments, presentation, facilities;	Online: Exhibition, Presentation, Slideshow, Hands-On, Demonstrations, Discussions	
2. Analysis and configuration of a programming system;		
3. Alpha (SMC) and Step7 (Siemens) programming environments, presentation, facilities, limits;		
4. Logical symbols and instructions, loading and transfer instructions;		
5. Block functions: standard block functions, logical block functions;		
6. Connecting the functional blocks, setting the parameters;		
7. Counting systems, Loading and transfer instructions;		

8. Timers, Data blocks, Internal clock;		
9 - Mathematical operators, Connection functions, Block functions, Jump instructions;		
10. Input-output extensions, interface and communication extensions Analog output inputs, Digital output inputs, Reference data, Comparison blocks;		
11. Analog output inputs, Digital output inputs, Reference data, Comparison blocks;		
12. Programming the electric actuators in the control loop, PID Instructions;		
13. Annotated examples of applications		
14. Final considerations and syntheses		

Bibliography:

1. SMC - Software manual – PneuAlpha ECC-PNAL-SOFT-B, Tokyo, Japan, 2004;
2. Siemens, Programing manual for STEP7, Index-22 A5E00706944-2001;
3. Petruzella F., Programmable Logic Controllers, McGraw Hill edition, NY, 2005, ISBN 978-0-07-122135-1
4. Popescu D., Automate programabile, Matrix Rom, Bucuresti, 2005, ISBN: 973-685-942-8
5. Ratiu, C., Controllere logic programabile pentru aplicatii industriale – suport de curs;
6. Ratiu, C., Controllere logic programabile – support pentru lucrari de laborator.

8.2 Seminar / laboratory / project	teaching methods	Remarks
1. Presentation of the laboratory, presentation of hard and soft equipment for the laboratory works, Labor protection.	Onsite: Actuation and control systems: 1. stands with logic units (microcontrollers)	
2. Assigning individual topics, analyzing, explaining how to unfold and commenting on them		
3. Elaboration by master students of the logical scheme for the application, determination of the number and type of inputs-outputs (2 sessions);		
4. Elaboration by master students of the program for the given topic, using Alpha or Step7 software - presentation of the intermediate stage (4 sessions);		
5. Elaboration by master students of the program for the given topic, using Alpha or Step7 software - presentation of the completed program (3 sessions);		
6. The transfer by the master students in the controller, of the elaborated program and its simulation;		
7. Presentation and support of the elaborated works.		

Bibliography:

7. SMC - Software manual – PneuAlpha ECC-PNAL-SOFT-B, Tokyo, Japan, 2004;
8. Siemens, Programing manual for STEP7, Index-22 A5E00706944-2001;
9. Petruzella F., Programmable Logic Controllers, McGraw Hill edition, NY, 2005, ISBN 978-0-07-122135-1
10. Popescu D., Automate programabile, Matrix Rom, Bucuresti, 2005, ISBN: 973-685-942-8
11. Ratiu, C., Controllere logic programabile pentru aplicatii industriale – suport de curs;
12. Ratiu, C., Controllere logic programabile – support pentru lucrari de laborator.

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

Identifying the requirements of the economic and industrial environment regarding the electrical drive systems of equipment and processes. Harmonization of the subjects of the discipline of drive systems according to the identified requirements of the industrial environment.

10. Assessement:

Activity type	10.1 Evaluation criterias	10.2 Evaluation methods	10.3 Share of final grade
10.4 Course	Understanding the notions defined and experienced in the courses.	Written assessment at the end of the semester.	50%
10.5 Seminar / Laboratory	Carrying out laboratory homework	Presentation of results from laboratory topics	50%
10.6 Minimum performance standard:			
The evaluation procedure for the theoretical component takes place online within the Teams platform according to the following note-competent distribution: • 5-6: proof of understanding the principles underlying the operation of microcontrollers; • 7-8 in addition, mastering the methods of elaborating the cyclograms of a process and the way of elaborating the programs: • 9-10 in addition, the way of supporting and arguing on given examples; The evaluation procedure for the practical component takes place online within the Teams platform according to the following note-competent distribution: • 5 - 6: Attendance at papers and submission of papers with appropriate content; • 7 - 8: The quality of the elaboration of the reports schemes, calculations, diagrams and program elaboration; 9 - 10: in addition, the way of supporting and arguing (oral) the papers.			

Completion date:	**Titular**	**Title First Name Name**	**Signature**
	Course	Prof. dr. ing. Claudiu Rațiu	
	Applications	Prof. dr. ing. Claudiu Rațiu	

Data avizării în Consiliul Departamentului IPR _____	Director Departament IPR Prof. dr. ing. Calin Neamțu
Data aprobării în Consiliul Facultății Construcții de Mașini _____	Decan Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Machine Building
1.3	Department	Design Engineering and Robotics
1.4	Field of study	Mechatronics and Robotics
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Robotics in english / Robotics
1.7	Form of education	IF-Full time
1.8	Subject code	32300910

2. Data about the subject

2.1	Subject name			Monitoring and Control of Robotic Manufacturing Processes		
2.2	Course responsible/lecturer			Assoc. Prof. dr. ing. Dan Hurgoiu; dan.hurgoiu@muri.utcluj.ro		
2.3	Teachers in charge of seminar / lab / project			Lecturer dr. ing. Vasile Tompa; vasile.tompa@muri.utcluj.ro		
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment		EX
2.7 Discipline regime	Formative category					X
	Optional					

3. Estimated total time

3.1 Number of hours per week	2	3.2 of which, course:	1	3.3 applications:	1
3.4 Total hours in the curriculum	28	3.5 of which, course:	14	3.6 applications:	14
(a) Individual study					hours
(b) Manual, lecture material and notes, bibliography					14
(c) Supplementary study in the library, online and in the field					12
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays					14
(e) Tutoring					0
(f) Exams and tests					4
(g) Other activities					0

3.7	Total hours of individual study	44
3.8	Total hours per semester	72
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	N/A
4.2	Competence	Bachelor's degree

5. Requirements (where appropriate)

5.1	For the course	Internet access; Access to a computer / student; MM projector; MS PowerPoint, Microsoft Teams
5.2	For the applications	Internet access; Access to a computer / student, Microsoft Teams

6. Specific competences

Professional competences	• Knowledge of the architecture and operation of various systems for monitoring and control of robotic production processes; selection and configuration of automated industrial process monitoring and control systems • Choosing the appropriate monitoring and control systems for various industrial processes; building monitoring and control applications using visual software environments and specific hardware solutions • Use of visual environments for monitoring and control of automated industrial processes • Establishing the optimal variants of monitoring and control systems of automated industrial processes and their components, as well as recommending solutions in various applications • Development of professional and / or research projects for the design of monitoring and control systems for automated and robotic industrial processes
Cross competences	• Applying the values and ethics of the engineering profession and responsible execution of complex professional tasks in conditions of professional autonomy and independence. Promoting logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision making. Planning your own work priorities, drawing up your own action plan. **Responsible execution of complex professional tasks** • Carrying out activities with the exercise of specific roles of teamwork on different hierarchical levels and with the assumption of leadership roles. Promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism and the continuous improvement of one's activity. Development of the portfolio of links and collaboration networks. Providing support for collaborators. Selection of team members. Planning team activities. Supporting the performance of team members. **Communication, teamwork and leadership** • Objective self-assessment and diagnosis of the need for continuous professional training in order to enter the labor market and adapt to the dynamics of its requirements and for personal and professional development. Self-control of learning and efficient use of language skills and knowledge of information and communication technology. **Professional self-development planning**

7. Discipline objectives (as results from the key competences gained)

7.1	General objective	• Development of skills in the field of monitoring and control systems of robotic manufacturing processes
7.2	Specific objectives	• Study of SCADA type distributed control systems • Study of DNC distributed numerical control systems • Study of Distributed control systems with PLC and remote I / O • Study of industrial control networks • Study of smart field equipment

8. Contents

8.1 Lecture (syllabus)	Nr. ore	Metode de predare	Observaţii
Basic notions regarding the control of industrial processes	2	Online teaching on MS Teams Multimedia exposure	
DAQ, PLC, CNC control systems	2		
SCADA type distributed control systems	2		
DNC distributed numerical control systems	2		
Distributed control systems with PLC and remote I / O	2		
Industrial control networks	2		
Smart field equipment	2		
Bibliografie:			

Electronic course support Hurgoiu, D.: Monitorizarea şi controlul proceselor de fabricaţie, Editura Casa Cărţii de Stiinţă, 2013, ISBN 978-606-17-0373-9; McMillan G.K., Considine D.M.: Process/industrial instruments and control handbook, 5th Edition, 1999.			
8.2 Applications/Seminars	Nr. ore	Metode de predare	Observaţii
Instrumentatia virtuală – NI LabVIEW	2	Practical applications on educational stands Multimedia	
Configurarea sistemelor de achizitii de date si comanda de proces – DAQ Designer	2		
Aplicaţii pentru măşurarea deplasărilor NI Elvis - Mechatronics	2		
Aplicaţie pentru controlul axelor cinematice NI Elvis - DC Motor Control	2		
Programarea şi controlul unui robot industrial I – NI DaNI	2		
Programarea şi controlul unui robot industrial II – NI DaNI	2		
Proiect individual	2		
Bibliography: Support for laboratory work in electronic format LabVIEW Programming Language Manual			

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

The acquired competencies will be necessary for the employees who carry out their activity in the companies that design or use automated manufacturing processes.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
Course	Theoretical evaluation	Written test	25%
Applications	Lab activity	Note each laboratory work application	25%
	Develop a practical application – Team project	Exam application	50%
10.4 Minimum standard of performance			
N=0,5E+0,25L+0,5P Conditions for obtaining credits: N> 5; E> 4; L> 4; P>4 Exam (E); Laboratory (note L); Project (note P)			

Data of filling in:	Teachers	Title Surname NAME	Signature
	Course	Assoc. Prof. dr. ing. Dan Hurgoiu	
	Applications	Lecturer dr. ing. Vasile Tompa	

Date of approval in the department _____	Head of department Prof. dr. ing. Călin NEAMȚU
Date of approval in faculty council _____	Dean Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS SHEET

1. Data about study program

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 School	Machine Buildings
1.3 Department	Design Engineering and Robotics
1.4 Field of study	Mechatronics and Robotics
1.5 Study cycle	Master
1.6 Study program	Robotics
1.7 Learning format	Full-time learning
1.8 Course unit code	9.00

2. Data about course unit

2.1 Course unit title			Design and Integration of Mechatronic Interfacing Systems		
2.2 Course responsible			Lect. PhD Eng. Mihai STEOPAN		
2.3 Lab responsible			Lect. PhD Eng. Mihai STEOPAN		
2.4 Year of study	1	2.5 Semester	2	2.6 Type of examination	CO
2.7 Course unit category	Formative				Sp
	Optional				Com

3. Total estimated duration

3.1 No. hrs/week	2	From which:	3.2 Course	1	3.3 Seminar	0	3.3 Lab	0	3.3 Project	1
3.4 No. hrs / semester	42	From which:	3.5 Course	14	3.6 Seminar	0	3.6 Lab	0	3.6 Project	14

3.7 Time distribution per semester:	
(a) Study based on notes, bibliography, course manuscripts	17
(b) Additional documentation in the library, Internet, in the field	25
(c) Preparation of lab work	26
(d) Tutorship	0
(e) Examinations	4
(f) Other activities	0
3.8 Total individual study (sum (3.7(a)...3.7(f)))	72
3.9 Total semester (3.4+3.8)	100
3.10 ECTS	4

4. Prerequisite

4.1 Curriculum	Mechanics, masine parts, electronics, electrotechnics
4.2 Competences	2/3D modelling, programming

5. Conditions

5.1. to run the course unit	Internet access, PC access, multimedia projector, spekers, MS PowerPoint or equivalent.
5.2. to run the applications	Internet access; Access to 3D / 2D modeling software packages and programming emulators; Access to a computer / student, motors, sensors, microcontrollers, reducers

6. Specific skills

Professional skills	• To plan and design a mechatronic interfacing device specific to industrial robots. • To know the structure and functionality of a mechatronic system. • To develop a kinematic and detailed scheme for a mechatronic interface system. • To dimension the components of the kinematic chain. • Model the components in a design software • Identify a microcontroller for a mechatronic device • Program a microcontroller for the application specific to the mechatronic device.
Transversal skills	• To apply the values and ethics of the engineering profession. • To perform responsibly complex professional tasks in conditions of professional autonomy and independence. • To promote logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision making. • Plan your own work priorities. • To self-control the learning and efficient use of language skills and knowledge of information and communication technology.

7. Course unit objectives

7.1 General objective	Development of skills and abilities to plan, analyze, implement, test and integrate mechatronic interfacing devices for industrial robots
7.2 Specific objectives	- - Expert use of software packages for modeling, simulation - - Development of mechatronic interfacing devices for the most widespread robotic applications in the productive environment - - Development of logical and creative thinking, individual study, critical and self-critical analysis

8. Contents

8.1 Topic	No. hrs	Teaching methods	Remarks
General aspects regarding the construction and application of industrial robots, mechatronic systems	1	Online with MS Teams; Theory; Examples; Q&A; Self-assessment; Individual exercises	
General information on the functional structure of serial industrial robots and mechatronic interfacing systems	1		
Functions, characteristics and principles of development	1		
Human-machine and machine-machine interfaces specific to mechatronic systems	1		
Kinematic and functional structure of devices	1		
Command and control of devices	1		
Integration of devices in robotic processes	1		
Bibliography: Course materials in electronic format			
8.2 Labs	No. hrs	Teaching methods	Remarks
Realization and finishing of a kinematic scheme for an interfacing device	1	Interactive onsite teaching: exemplification – verification of progress – additional explanations	
Realization of the structural-functional scheme for a device	1		
Identifying forces and moments based on structurally functional schemes and sizing kinematic chains	1		
Identification of constructive elements of detail	1		
Determining the critical elements in the device and checking them, creating the code for the microcontroller	1		
3D modelling of the device	1		
Finishing the calculation justification memorandum and the 2D drawing	1		
Bibliography: Course materials in electronic format, Online materials			

9. Corroboration with other elements

Hands on course unit. Learn technologies applied in Romania and EU. Use cases from industry. Real life applications.

10. Evaluation

Type activity	10.1 Evaluation criteria	10.2 Assessment	10.3 Distribution
10.4 Course	-	-	-
10.5 Lab	Completeness Number of solved cases Correctness of solutions and engineering	Presentation and checking of the work	100%
10.6 Minimum standard Modelled and functional mechanical structure 50% Modelled and functional electrical system structure 30% Functional Program for microcontroller 20%			

Date:	Chair	Title Name SURNAME	Signature
	Course	S.l.dr.ing. Mihai STEOPAN	
	Applications	S.l.dr.ing. Mihai STEOPAN	

Date approval Council of Dept. IPR

_____

Director of Department
Prof. dr. eng. Călin NEAMȚU

Date approval Council of School CM

_____

Dean
Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS SHEET

1. Data about study program

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 School	Industrial Engineering, Robotics, and Management of Production
1.3 Department	Design Engineering and Robotics
1.4 Field of study	Mechatronics and Robotics
1.5 Study cycle	Master
1.6 Study program	Robotics
1.7 Learning format	Full-time learning
1.8 Course unit code	10.00

2. Data about course unit

2.1 Course unit title			Robotic Applications		
2.2 Course responsible			Prof. dr. eng. Stelian Brad stelian.brad@staff.utcluj.ro		
2.3 Lab responsible			Prof. dr. eng. Stelian Brad stelian.brad@staff.utcluj.ro		
2.4 Year of study	1	2.5 Semester	2	2.6 Type of examination	EX
2.7 Course unit category	Formative				X
	Optional				

3. Total estimated duration

3.1 No. hrs/week	3	From which:	3.2 Course	2	3.3 Seminar	0	3.3 Lab	1	3.3 Project	0
3.4 No. hrs / semester	42	From which:	3.5 Course	28	3.6 Seminar	0	3.6 Lab	14	3.6 Project	0

3.7 Time distribution per semester:	
(a) Study based on notes, bibliography, course manuscripts	14
(b) Additional documentation in the library, Internet, in the field	0
(c) Preparation of lab work	40
(d) Tutorship	0
(e) Examinations	4
(f) Other activities	0

3.8 Total individual study (sum (3.7(a)...3.7(f)))	58
3.9 Total semester (3.4+3.8)	100
3.10 ECTS	4

4. Prerequisite

4.1 Curriculum	Programming Languages of Industrial Robots
4.2 Competences	RAPID programming language

5. Conditions

5.1. to run the course unit	A hands-on course unit. The course is run in the lab because all information is immediately tested on the physical system. By this approach programming skills on various technologies and various robotic cells and applications are thoroughgoing.
5.2. to run the applications	ABB, Fanuc, Kuka, Motoman, UR robotic cells / Lab with internet access, server RobotStudio/RAPID, a room with 15 computers for individual work

6. Specific skills

Professional skills	• To know constructive elements and design principles of robotic cells for various industrial applications • To program at least in four programming languages specific to industrial robots • To operate with industrial robots from ABB, Kuka, Motoman, Fanuc, UR, Comau, UR Factory
Transversal skills	• To apply values and ethics of the engineering profession • To execute with responsibility complex professional tasks in autonomous conditions and professional independence • To promote logical reasoning, convergent and divergent, of practical applications, of assessment and self-assessment in decision-making • To plan own work priorities • To self-control learning and efficient use of knowledge on information technologies

7. Course unit objectives

7.1 General objective	Develop skills to plan, analyse, build, integrate robot applications in an advanced programming language dedicated to industrial robots
7.2 Specific objectives	- Use programming languages for Kuka, ABB, Motoman, Fanuc, Comau, UR Factory, UR robots - Build applications for most used robotic processes in production - Develop logical thinking and creative thinking, of individual study, of critical and self-critical analysis

8. Contents

8.1 Topic	No. hrs	Teaching methods	Remarks
Arc welding application in a ABB robotic cell	2	Theory; Examples; Q&A; Self-assessment; Individual exercises	
Assembly and handling application with Motoman robot	2		
Complex handling application with a 2-arm Motoman robot and an index table	2		
Video inspection and smart handling in a ABB robotic cell	2		
Contouring application and tool exchange with a Kuka robot	2		
Assembly application with two UR collaborative robots	2		
Contouring application with fixed tool in a ABB robotic cell	2		
Cloud-based human-robot interaction with a Kuka robot, NodeRED and artificial intelligence	2		
Machine tending with a Fanuc robotic cell	2		
Part handling with multiple entry combinations in a Kuka robotic cell	2		
Assembly application with a 2-arm ABB collaborative robot	2		
Part handling with a Kuka collaborative robot	2		
Part handling with a Comau collaborative robot	2		
Part handling with a UR Factory collaborative robot	2		
Bibliography: Course materials in electronic format Manual of RAPID programming language Manual of KRL programming language Manual of INFORM programming language Manual of KAREL programming language Manual of UR Script programming language			
8.2 Labs	No. hrs	Teaching methods	Remarks
Complex assembly application with an UR robot	2		

Arc welding application with an ABB robot	2	Interactive onsite teaching: exemplification – verification of progress – additional explanations	
Handling, contouring with fixed tool with an ABB robot	2		
Handling operation with an ABB robot	2		
Inspection application with a Fanuc robot	2		
Contouring application and tool exchange with a Kuka robot	2		
Assembly application with a Motoman robot	2		
Bibliography: Course materials in electronic format Manual of RAPID programming language Manual of KRL programming language Manual of INFORM programming language Manual of KAREL programming language Manual of UR Script programming language Online materials			

9. Corroboration with other elements

Hands on course unit. Learn technologies applied in Romania and EU. Use cases from industry. Real life applications.

10. Evaluation

Type activity	10.1 Evaluation criteria	10.2 Assessment	10.3 Distribution
10.4 Course	Completeness Ingenuity and simplicity in defining solutions Degree of knowledge of instructions and key algorithms	Evaluation of 6 applications during the semester	50%
10.5 Lab	Completeness Number of solved cases Correctness of solutions	Average of marks for the applications realized in the lab	50%
10.6 Minimum standard Minimum 4 applications solved Test: min. 50%			

Date:	Chair	Title Name SURNAME	Signature
	Course	Prof. dr. eng. Stelian BRAD	
	Applications	Prof. dr. eng. Stelian BRAD	

Date approval Council of Dept. IPR _____	Head of Department Prof. dr. eng. Călin NEAMȚU
Date approval Council of IIRPM School _____	Dean Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Machine Building
1.3	Department	Engineering Design and Robotics
1.4	Field of study	Mechatronics and Robotics
1.5	Cycle of study	Master of Science
1.6	Program of study/Qualification	Robotics in English at Cluj-Napoca
1.7	Form of education	Full time
1.8	Subject code	11.10

2. Data about the subject

2.1 Subject name	**Reliability, maintenance, and safety in operation of industrial robotic systems**				
2.2 Course responsible/lecturer	Assoc.Prof.Eng. Bogdan Mocan, PhD ***bogdan.mocan@muri.utcluj.ro***				
2.3 Teachers in charge of seminars, lab, or project	Assoc.Prof.Eng. Bogdan Mocan, PhD ***bogdan.mocan@muri.utcluj.ro***				
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment	C
2.7 Subject category	Formative category				DS
	Optional				DO

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

3.1 Number of hours per week	3	of which, 3.2 course	2	3.3 Seminar	-	3.3 Lab	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which, 3.5 course	28	3.6 Seminar	-	3.6 Lab	14	3.6 Project	-

3.7 Distribution of time (hours per semester) for:	ore
(a) Study by textbook, course support, bibliography, and notes	15
(b) Additional documentation in the library, on specialized electronic platforms and in the field	25
(c) Preparation of seminars / laboratories, topics, papers, portfolios, and essays	15
(d) Tutoring	
(e) Examinations	3
(f) Other activities:	0
3.8 Total hours of individual study (sum (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	Not applicable
4.2 Competences	Ability to understand the operation of an industrial robot, identify the category it belongs to and its type; The ability to integrate, through logical reasoning, robots into industrial processes. The ability to select the end-effectors with which the robots can perform different work tasks.

5. Requirements (where appropriate)

5.1. For the course	• ***Face-to-Face***: Classroom with video projector and internet access. • ***On-line***: Teams Software Platform

5.2. For the seminar/laboratory/ project	• Laboratory - Robotization Manufacturing - with industrial robotics systems (e.q. ABB, KUKA, Motoman) and specific maintenance tools • Laboratory attendance is mandatory

6. Specific competences

Professional competences	Production planning and quality management in robotic systems, use of information systems in production, maintenance and operation of industrial robots and flexible manufacturing systems
Cross competences	C6.1. Understanding the CAPP (Computer-aided process planning) concept, knowledge of CAPP methods and their variants in various cases, knowledge of the role of information systems in the context of globalized production, understanding of integrated information systems architectures, including ERP, MES, CMMS, knowledge of models and procedures related to maintenance and reliability of industrial robots and equipment automated manufacturing, understanding of management methodologies and improvement of robotic processes C6.2. Planning a complete manufacturing process in which industrial robots are used, developing applications using various information media for production planning in distributed systems and for integrating automated manufacturing systems with information systems, planning and conducting reliability tests of industrial robots, developing a preventive plan for the maintenance of robotic lines, planning, implementation, operation and analysis of quality control systems in robotic / automated processes C6.3. Use of CAPP, ERP, CMMS, MES software packages, use of mathematical statistics and probability theory in estimating reliability parameters, use of software applications for planning and implementing preventive maintenance actions, use of planning and quality control methods and specific software environments C6.4. Evaluation and establishment of optimal variants for CAPP, ERP, MES, CMMS systems, for preventive maintenance plans, for control and quality assurance plans in automated / robotic production processes C6.5. Elaboration of professional and / or research projects for the accomplishment of the preventive maintenance, for the implementation of a CAPP and ERP system in the automated and robotic industrial processes, the accomplishment of a quality control plan

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Development of competencies in the field of reliability and maintenance of robotic systems, in support of professional training.
7.2 Specific objectives	• Assimilation of theoretical knowledge specific to the field of reliability, maintenance, and operational safety of technical systems, with applicability in industrial robotics. • Obtaining skills for the application of methods, models, and procedures in the field of reliability and maintenance of technical systems in the case of industrial robots and flexible manufacturing systems.

8. Contents

8.1 Lecture (syllabus) – COURSE	**No hours**	**Teaching methods**	**Notes**
Course 1: Reliability, maintenance, and safety of technical assets - general aspects	2	**Face to fata** Presentation, slideshow presentation, discussions & **On-line**	Students are encouraged to ask questions and actively participate in debates.
Course 2: Types of maintenance - Proactive types of maintenance	2		
Course 3: Types of maintenance - Reactive types of maintenance	2		
Course 4: Types of maintenance - Other types of maintenance	2		

Course 5: Comparison of Different Types of Maintenance - Implementation conditions	2	using MS Teams platform	Internet access for all students
Course 6: Maintenance Applications - Industrial Maintenance; Production Facility Maintenance	2		
Course 7: Modelling equipment wear in terms of reliability theory Tests of reliability of technical systems	2		
Course 8: Maintenance Tools for analysing why and when assets fail - P-F Curve; FMEA; Root Cause Analysis; Lean Six Sigma; SCADA System; Planned Maintenance Optimization	2		
Course 9: Standards regarding Technical Reliability of an asset: ISO 55000; ISO 55001; ISO 55002.	2		
Course 10: Regulations regarding Technical Reliability of an asset: OSHA Maintenance Regulations; IRS Maintenance Regulations	2		
Course 11: Maintenance Software: How to Choose a Maintenance Program	2		
Course 12: Practical Application of Robot Safety - Risk Assessment; Safeguarding application; Safe distance calculations; Determining "stopping time"; Hints that safeguards are working as expected or not working; Safety reviews	2		
Course 13: Standards regarding safety in industrial robotic cells: ISO 10218-1; ISO 10218-2; ISO 11161	2		
Course 14: Reliability, maintenance, and safety of industrial robotics systems in the context of INDUSTRY 4.0	2		

Bibliography

1. Course Notes, Mocan Bogdan, 2020-2021
2. Blebea, I., Mocan, B., Steopan A., *Fiabilitatea, Mentenabilitatea şi Siguranţa Sistemelor de Producţie*, Editura UT Press, ISBN 978-973-662-842-9, 292 pg., Cluj-Napoca, 2013.
3. Mocan, B., Fulea, M., Brad, E. and Brad, S., State-of-the-Art and Proposals on Reducing Energy Consumption in the Case of Industrial Robotic Systems, Proceedings of the 2014 International Conference on Production Research – Regional Conference Africa, Europe and the Middle East; 3rd International Conference on Quality and Innovation in Engineering and Management, Cluj-Napoca, Romania, 1-5 July, ISBN: 978-973-662-978-5, pp. 328-334, 2014.
4. Mocan, B., Fulea, M., Brad, S., Reliability Assessment of Lean Manufacturing Systems, Proceedings of The 1st International Conference on Quality and Innovation in Engineering and Management , ISBN 978-973-662-614-2, pp. 127-130, 2011.

Alternative sources of information

1. **Mobile apps** - Google Android: Industrial Automation Tutorial; Industrial Automation; Electrical Drives; Automation & Controls Today; Learn PLC SCADA
2. **Youtube**: The Robot Revolution: The New Age of Manufacturing; How industrial robot is made? ; Smart Factory; Internet of Things; IORT Internet of robotic things;
3. **Robotic Blogs**: Robotics Trends; Robot Facts That Everyone Should Know; Robotics within reach; Robotic News for the Factory; Smart Collaborative Robots; Powering the world's robots; Robotics; MIT Technology Review.

8.2 LABORATORY	No hours	Teaching methods	Notes
1. Installation and calibration of the ABB IRB 1600/ Fanuc LR Mate 200iC/ Motoman SDA20D robots	2	**Face to fata** Presentation, slideshow	Internet access for all students
2. Defining the end effector for a robot system - ABB IRB 1600/ Fanuc LR Mate 200iC/ Motoman SDA20D robots	2		

3. Change procedures of back-up batteries for ABB IRB 1600/ Fanuc LR Mate 200iC/ Motoman SDA20D robotic systems		presentation, discussions & **On-line** using MS Teams platform	
4. Preventive maintenance plan for industrial robots (ex. ABB IRB 1600, Fanuc LR Mate 200iC, Motoman) *Maintenance schedule and expected component life; Specification of maintenance intervals; Maintenance schedule; Expected component life; Inspection activities; Inspection, damper axes 2, 3 and 5; Replacement activities; Oil in gearboxes; Oil change, gearbox axes 5 and 6; Replacement of measurement system battery pack; Cleaning activities; Cleaning, complete robot.*	2		
5. Risk assessment plan for a robotic cell (ex. ABB IRB 1600, Fanuc LR Mate 200iC, Motoman) 1. Identify potential hazards; 2. Potential severity of hazards; 3. Frequency of exposure to hazards; 4. Strategies to implement to minimize hazards and avoid harm	4		
6. Reliability - centred maintenance plan (RCM) for an industrial asset The primary objective is to preserve system function; Identify failure modes that can affect the system function; Prioritize the failure modes; Select applicable and effective tasks to control the failure modes.	2		

Bibliography

1. Laboratory Notes, Mocan Bogdan, 2020-2021
2. Blebea, I., Mocan, B., Steopan A., *Fiabilitatea, Mentenabilitatea şi Siguranţa Sistemelor de Producţie*, Editura UT Press, ISBN 978-973-662-842-9, 292 pg., Cluj-Napoca, 2013.
3. Mocan, B., Fulea, M., Brad, E. and Brad, S., State-of-the-Art and Proposals on Reducing Energy Consumption in the Case of Industrial Robotic Systems, Proceedings of the 2014 International Conference on Production Research – Regional Conference Africa, Europe and the Middle East; 3rd International Conference on Quality and Innovation in Engineering and Management, Cluj-Napoca, Romania, 1-5 July, ISBN: 978-973-662-978-5, pp. 328-334, 2014.
4. Mocan, B., Fulea, M., Brad, S., Reliability Assessment of Lean Manufacturing Systems, Proceedings of The 1st International Conference on Quality and Innovation in Engineering and Management , ISBN 978-973-662-614-2, pp. 127-130, 2011.

Alternative sources of information

1. **Mobile apps** - Google Android: Industrial Automation Tutorial; Industrial Automation; Electrical Drives; Automation & Controls Today; Learn PLC SCADA
2. **Youtube**: The Robot Revolution: The New Age of Manufacturing; How industrial robot is made? ; Smart Factory; Internet of Things; IORT Internet of robotic things;
3. **Robotic Blogs**: Robotics Trends; Robot Facts That Everyone Should Know; Robotics within reach; Robotic News for the Factory; Smart Collaborative Robots; Powering the world's robots; Robotics; MIT Technology Review.

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

The competences developed in this course will be required by engineers involved in the integration and maintenance of machine tools, industrial robots, and manufacturing equipment and devices in various automated manufacturing processes and industrial robotic systems.
The acquired competencies will be necessary for the employees who carry out their activity within the maintenance teams.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Answers to 20 questions from all courses (theory evaluation)	Written test - duration of assessment 1 hours	40%
10.5 Laboratory	Development of a: 1. Preventive maintenance plan for industrial robots (ex. ABB IRB 1600, Fanuc LR Mate 200iC, Motoman) 2. Risk assessment plan for a robotic cell (ex. ABB IRB 1600, Fanuc LR Mate 200iC, Motoman) and 3. Reliability - centred maintenance plan (RCM) for an industrial asset	Public presentation -of each report, duration 20 minutes including answer to project related questions (max. 5 min)	60%

10.6 Minimum performance standard

Theory evaluation (course)*:* correct answer to at least 10 questions in the written test.

Lab Evaluation*:* Promoting lab activity with min. 5 grade, according to the assessment method highlighted above.

Promotion of the discipline exam: get the 5th grade at each above-mentioned test – theory evaluation, lab test.

Date of filling in:	Lecturer	Title Surname Name	Signature
	Course	Assoc.Prof.Eng. Bogdan Mocan, PhD	
	Teachers in charge of application	Assoc.Prof.Eng. Bogdan Mocan, PhD	

Date of approval in the Council of IPR Department

_____

Head of department,
Prof.dr.ing. Calin NEAMTU

Date of approval in the Faculty of Machine Building

_____

Dean,
Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Machine Building
1.3	Department	Engineering Design and Robotics
1.4	Field of study	Mechatronics and Robotics
1.5	Cycle of study	Master of Science
1.6	Program of study/Qualification	Robotics in English at Cluj-Napoca
1.7	Form of education	Full time
1.8	Subject code	11.20

2. Data about the subject

2.1 Subject name	**Robotic manufacturing systems**				
2.2 Course responsible/lecturer	Assoc.Prof.Eng. Bogdan Mocan, PhD ***bogdan.mocan@muri.utcluj.ro***				
2.3 Teachers in charge of seminars, lab, or project	Assoc.Prof.Eng. Bogdan Mocan, PhD ***bogdan.mocan@muri.utcluj.ro***				
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment	C
2.7 Subject category	Formative category				DS
	Optional				DO

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

3.1 Number of hours per week	3	of which, 3.2 course	2	3.3 Seminar	-	3.3 Lab	1	3.3 Project	-
3.4 Total hours in the curriculum	42	of which, 3.5 course	28	3.6 Seminar	-	3.6 Lab	14	3.6 Project	-

3.7 Distribution of time (hours per semester) for:	ore
(a) Study by textbook, course support, bibliography, and notes	15
(b) Additional documentation in the library, on specialized electronic platforms and in the field	25
(c) Preparation of seminars / laboratories, topics, papers, portfolios, and essays	15
(d) Tutoring	
(e) Examinations	3
(f) Other activities:	0
3.8 Total hours of individual study (sum (3.7(a)…3.7(f)))	58
3.9 Total hours per semester (3.4+3.8)	100
3.10 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	Not applicable
4.2 Competences	Ability to understand the operation of an industrial robot, identify the category it belongs to and its type; The ability to integrate, through logical reasoning, robots into industrial processes. The ability to select the end-effectors with which the robots can perform different work tasks.

5. Requirements (where appropriate)

5.1. For the course	• ***Face-to-Face***: Classroom with video projector and internet access. • ***On-line***: Teams Software Platform

5.2. For the seminar/laboratory/ project	• Familiar with RoboDK software platform • Laboratory attendance is mandatory

6. Specific competences

Professional competences	Understanding the general assembly of industrial robots (RI), perirobotic systems (SPR) of transport and transfer systems (SAT) and related systems (SC) used in robotic applications, implementation, assisted 3D modeling and RI, SPR, SATT simulation, SC in specific applications of different technological processes. Use of modern assessment methods (assisted calculation, modeling, simulation, optimization of operation) in the optimal design of robotic subsystems and hardware interfaces and virtual instrumentation software specific for the acquisition, processing and interpretation of experimental data.
Cross competences	C6.2. Planning a complete manufacturing process in which industrial robots are used, developing applications using various information media for production planning in distributed systems and for integrating automated manufacturing systems with information systems, planning and conducting reliability tests of industrial robots, developing a preventive plan for the maintenance of robotic lines, planning, implementation, operation and analysis of quality control systems in robotic / automated processes C6.5. Elaboration of professional and / or research projects for the accomplishment of the preventive maintenance, for the implementation of a CAPP and ERP system in the automated and robotic industrial processes, the accomplishment of a quality control plan

7. Discipline objectives (as results from the key competences gained)

7.1 General objective	Development of competencies in the field of industrial robotic systems, in support of professional training.
7.2 Specific objectives	• Assimilation of theoretical knowledge specific to the field of industrial robotics systems and related equipment. • Obtaining skills for the application of methods, models, and procedures in the field of industrial robots and flexible manufacturing systems.

8. Contents

8.1 Lecture (syllabus) – COURSE	**No hours**	**Teaching methods**	**Notes**
Course 1: Introduction to Industrial Robotics Manufacturing	2	**Face to fata** Presentation, slideshow presentation, discussions & **On-line** using MS Teams platform	Students are encouraged to ask questions and actively participate in debates. Internet access for all students
Course 2: The Impact of Robotics on Manufacturing	2		
Course 3: Robotic material handling systems	2		
Course 4: End effectors used in industrial robotics - types of final effectors, technical configurations, ways to drive the final effectors	2		
Course 5: Robotic arc welding manufacturing processes	2		
Course 6: Robotic spot-welding manufacturing processes	2		
Course 7: Robotic Assembling of Products	2		
Course 8: Robotic palletising systems	2		
Course 9: Robotic machine tending systems	2		
Course 10: Errors in the design and implementation of robotic systems / robotic cells for handling, assembling, welding.	2		
Course 11: Aspects regarding collaborative robots - types of collaborative robots, ways of programming them, ways to integrate into production processes and how to implement them into industrial processes	2		
Course 12: Criteria for evaluating the performance of robotized production cells / systems	2		

Course 13: Standards regarding safety in industrial robotic cells: ISO 10218-1; ISO 10218-2; ISO 11161	2		
Course 14: Future of Robotics in Manufacturing	2		

Bibliography

1. Course Notes, Mocan Bogdan, 2020-2021
2. Mocan, B., Brad, S., Fulea, M, Murar, M., Stan, A., Timoftei, S., Multidisciplinary Design of Industrial Robotic Automation Solutions - Practical Guide For Students - Editura UTPress, ISBN 978-606-737-246-5, 240 pg., Cluj-Napoca, 2018.
3. Mocan, B., Timoftei, S., Stan, A., Fulea, M., RobotStudio® - Simulation of industrial automation processes and offline programming of ABBs robots - Practical guide for students - Editura UTPress, ISBN 978-606-737-254-0, 140 pg., Cluj-Napoca, 2017.
4. Mocan, B., Brad, S., Fulea, M., Automatizarea și Robotizarea Fabricației Structurilor Sudate, Editura UTPress, ISBN 978-606-737-052-2, 290 pg., Cluj-Napoca, 2015.Mocan, B., Fulea, M., Brad, E. and Brad, S., State-of-the-Art and Proposals on Reducing Energy Consumption in the Case of Industrial Robotic Systems, Proceedings of the 2014 International Conference on Production Research – Regional Conference Africa, Europe and the Middle East; 3rd International Conference on Quality and Innovation in Engineering and Management, Cluj-Napoca, Romania, 1-5 July, ISBN: 978-973-662-978-5, pp. 328-334, 2014.
5. Mocan, B., Fulea, M., Brad, S., Reliability Assessment of Lean Manufacturing Systems, Proceedings of The 1st International Conference on Quality and Innovation in Engineering and Management , ISBN 978-973-662-614-2, pp. 127-130, 2011.

Alternative sources of information

1. **Mobile apps** - Google Android: Industrial Automation Tutorial; Industrial Automation; Electrical Drives; Automation & Controls Today; Learn PLC SCADA
2. **Youtube**: The Robot Revolution: The New Age of Manufacturing; How industrial robot is made? ; Smart Factory; Internet of Things; IORT Internet of robotic things;
3. **Robotic Blogs**: Robotics Trends; Robot Facts That Everyone Should Know; Robotics within reach; Robotic News for the Factory; Smart Collaborative Robots; Powering the world's robots; Robotics; MIT Technology Review.

8.2 LABORATORY	**No hours**	**Teaching methods**	**Notes**
1. Familiarize students with the RoboDK® work environment (menus, save, import, export CAD files). Create and modify objects in the RoboDK® work environment.	2	**Face to fata** Presentation, slideshow presentation, discussions & **On-line** using MS Teams platform	Internet access for all students
2. Advanced aspects regarding creating and modifying the mechanisms and tools in the RoboDK® work environment.	2		
3. Advanced aspects regarding defining, and building a robotic cell using the RoboDK® work environment.			
4. Advanced aspects regarding integrate various CAD elements (robots, mechanisms, work tools, auxiliary devices) into a robotic cell using the RoboDK® work environment.	2		
5. Advanced aspects regarding defining the auxiliary mechanisms of robotic cells in the RoboDK® work environment.	2		
6. Advanced aspects regarding robot motion simulation (creating and modifying robot work points, creating, and modifying a robot trajectory, defining, and modifying reference systems) using the RoboDK® work environment.	2		

7. Advanced aspects regarding programming ABB, Fanuc, Kuka, UR, etc. robots using RoboDK® environment.	2		

Bibliography

1. Laboratory Notes, Mocan Bogdan, 2020-2021
2. Course Notes, Mocan Bogdan, 2020-2021
3. Mocan, B., Brad, S., Fulea, M, Murar, M., Stan, A., Timoftei, S., Multidisciplinary Design of Industrial Robotic Automation Solutions - Practical Guide For Students - Editura UTPress, ISBN 978-606-737-246-5, 240 pg., Cluj-Napoca, 2018.
4. Mocan, B., Timoftei, S., Stan, A., Fulea, M., RobotStudio® - Simulation of industrial automation processes and offline programming of ABBs robots - Practical guide for students - Editura UTPress, ISBN 978-606-737-254-0, 140 pg., Cluj-Napoca, 2017.
5. Mocan, B., Brad, S., Fulea, M., Automatizarea și Robotizarea Fabricației Structurilor Sudate, Editura UTPress, ISBN 978-606-737-052-2, 290 pg., Cluj-Napoca, 2015.Mocan, B., Fulea, M., Brad, E. and Brad, S., State-of-the-Art and Proposals on Reducing Energy Consumption in the Case of Industrial Robotic Systems, Proceedings of the 2014 International Conference on Production Research – Regional Conference Africa, Europe and the Middle East; 3rd International Conference on Quality and Innovation in Engineering and Management, Cluj-Napoca, Romania, 1-5 July, ISBN: 978-973-662-978-5, pp. 328-334, 2014.
6. Mocan, B., Fulea, M., Brad, S., Reliability Assessment of Lean Manufacturing Systems, Proceedings of The 1st International Conference on Quality and Innovation in Engineering and Management , ISBN 978-973-662-614-2, pp. 127-130, 2011.

Alternative sources of information

7. **Mobile apps** - Google Android: Industrial Automation Tutorial; Industrial Automation; Electrical Drives; Automation & Controls Today; Learn PLC SCADA
8. **Youtube**: The Robot Revolution: The New Age of Manufacturing; How industrial robot is made? ; Smart Factory; Internet of Things; IORT Internet of robotic things;
9. **Robotic Blogs**: Robotics Trends; Robot Facts That Everyone Should Know; Robotics within reach; Robotic News for the Factory; Smart Collaborative Robots; Powering the world's robots; Robotics; MIT Technology Review.

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

The skills developed in this course will be required by engineers involved in the automation and robotization of various industrial process processes (from the planning stage to designing a robotic solution, design, off-line programming and implementation).

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Answers to 20 questions from all courses (theory evaluation)	Written test - duration of assessment 30 min.	40%
10.5 Laboratory	Development of robotic applications (installation, welding, handling, inspection video) medium to high complexity in software RoboDK®	Practical test - duration 1 hour	60%

10.6 Minimum performance standard

Theory evaluation (course)*:* correct answer to at least 10 questions in the written test.

Lab Evaluation*:* Promoting lab activity with min. 5 grade, according to the assessment method highlighted above.

Promotion of the discipline exam: get the 5th grade at each above-mentioned test – theory evaluation, lab test.

Date of filling in:	Lecturer	Title Surname Name	Signature
	Course	Assoc.Prof.Eng. Bogdan Mocan, PhD	
	Teachers in cnarge oт application	Assoc.Prof.Eng. Bogdan Mocan, PhD	

Date of approval in the Council of IPR Department _____	Head of department, Prof.dr.ing. Calin NEAMTU
Date of approval in the Faculty of Machine Building _____	Dean, Prof. eng. Stelian BRAD, Ph.D.

FIȘA DISCIPLINEI

1. Date despre program

1.1 Instituția de învățământ superior	Universitatea Tehnică din Cluj-Napoca
1.2 Facultatea	Facultatea de Inginerie Industrială, Robotică și Managementul Producției
1.3 Departamentul	Ingineria proiectării și robotică
1.4 Domeniul de studii	Mecatronică și robotică
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	Robotică (engleză)
1.7 Forma de învățământ	IF - învățământ cu frecvență
1.8 Codul disciplinei	13.00

2. Date despre disciplină

2.1 Denumirea disciplinei				Asigurarea și controlul calității în procesele robotizate	
2.2 Aria de conținut				Disciplină de specializare	
2.3 Titularul de curs				Prof.dr.ing. Sorin Popescu - sorin.popescu@muri.utcluj.ro	
2.4 Titularul activităților de seminar / laborator / proiect				Conf.dr.ec. - diana.dragomir@muri.utcluj.ro	
2.5 Anul de studiu	2	2.6 Semestrul	1	2.7 Tipul de evaluare	E
2.8 Regimul disciplinei	Categoria formativă				DS
	Opționalitate				DI

3. Timpul total estimate

3.1 Număr de ore pe săptămână	3	din care:	3.2 Curs	2	3.3 Seminar		3.3 Laborator	1	3.3 Proiect	
3.4 Număr de ore pe semestru	42	din care:	3.5 Curs	28	3.6 Seminar		3.6 Laborator	14	3.6 Proiect	

3.7 Distribuția fondului de timp (ore pe semestru) pentru:	
(a) Studiul după manual, suport de curs, bibliografie și notițe	28
(b) Documentare suplimentară în bibliotecă, pe platforme electronice de specialitate și pe teren	11
(c) Pregătire seminarii / laboratoare, teme, referate, portofolii și eseuri	14
(d) Tutoriat	2
(e) Examinări	3
(f) Alte activități:	0

3.8 Total ore studiu individual (suma (3.7(a)...3.7(f)))	58
3.9 Total ore pe semestru (3.4+3.8)	100
3.10 Numărul de credite	4

4. Precondiții (acolo unde este cazul)

4.1 de curriculum	Cunoștințe de bază în inginerie
4.2 de competențe	Cunoștințe generale de operare pe PC

5. Condiții (acolo unde este cazul)

5.1. de desfășurare a cursului	Online
5.2. de desfășurare a seminarului / laboratorului / proiectului	Onsite; Prezența la activitățile de laborator este obligatorie

6. Competențele specifice acumulate

Competente profesionale	Planificarea producției și managementul calității în sisteme robotizate, utilizarea sistemelor informaționale în producție, mentenanța și exploatarea roboților industriali și a sistemelor flexibile de fabricație.
Competente transversale	Disciplina contribuie la dezvoltarea competențelor transversale de rezolvare a problemelor, lucru în echipă și abordare bazată pe riscuri și pe procese în cadrul organizațiilor care utilizează procese robotizate sau automatizate.

7. Obiectivele disciplinei (reieșind din grila competențelor specifice acumulate)

7.1 Obiectivul general al disciplinei	Cursul are ca scop să transmită studenților competențe privind proiectarea, operarea și îmbunătățirea sistemelor și proceselor de asigurare și urmărire a calității în organizații de producție în general și în particular a celor care dispun de procese de producție automatizate/robotizate.
7.2 Obiectivele specifice	După parcurgerea disciplinei, studenții vor cunoaște: - conceptele de baza privitoare la calitate si modele de organizare pentru calitate în organizații de producție, in particular in cazul proceselor automatizate/ robotizate; - metodologii pentru ingineria și managementul proceselor de producție robotizată; - instrumentele și mijloacele tehnice de asigurare, control și îmbunătățire a calității; - noțiuni privind controlul statistic al proceselor și abordarea Six sigma în procese de producție. După parcurgerea disciplinei studenții vor fi capabili să planifice, să implementeze, să opereze și să analizeze sisteme de asigurare și control al calității în sisteme de producție automatizate/robotizate.

8. Conținuturi

8.1 Curs	Nr. ore	Metode de predare	Observații
Demersul privind calitatea importanță evoluție și tendințe	4	Expunere interactivă Elemente multimedia online Discuții și întrebări	
Modele pentru managementul calității în procese robotizate	4		
Abordarea sistemica orientata spre procese	4		
Soluționarea problemelor in îmbunătățirea continua	4		
Tehnici si instrumente ale calității	4		
Controlul statistic al proceselor - SPC	4		
Elemente Six Sigma și Lean Six Sigma	4		
Bibliografie 1. Popescu, S., Dragomir, D., Asigurarea și controlul calității în procesele robotizate, Suport de curs, 2021 2. M. Dragomir, S. Popescu, Managementul calității în întreprinderile industriale. Curs universitar, Editura Mega, Cluj-Napoca, 2013 3. Joseph A. Defeo, Juran's Quality Handbook: The Complete Guide to Performance Excellence, Seventh Edition, McGraw-Hill Education, 2016			
8.2 Seminar / laborator / proiect	Nr. ore	Metode de predare	Observații
Identificarea proceselor și relațiilor - Process Structure Matrix	2		
Metodologia de rezolvare a problemelor Ford 8D I	2		

Metodologia de rezolvare a problemelor Ford 8D II	2	Elemente multimedia online Rezolvare exerciții, studii de caz	
Analiza riscurilor în procese de fabricație - FMEA	2		
SPC instrumente ale controlului statistic I	2		
SPC instrumente ale controlului statistic II	2		
Proiecte de îmbunătățire DMAIC și Value Stream Mapping	2		

Bibliografie

1. Popescu, S., Dragomir, D., Asigurarea și controlul calității în procesele robotizate, Suport de curs, 2021

2. M. Dragomir, S. Popescu, Managementul calității în întreprinderile industriale. Curs universitar, Editura Mega, Cluj-Napoca, 2013

3. Joseph A. Defeo, Juran's Quality Handbook: The Complete Guide to Performance Excellence, Seventh Edition, McGraw-Hill Education, 2016

9. Coroborarea conținuturilor disciplinei cu așteptările reprezentanților comunității epistemice, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului

Disciplina are un puternic caracter aplicativ, fiind orientată înspre furnizarea de cunoștințe, abilități și deprinderi privitoare la ingineria calității căutate pe piața muncii pentru toate tipurile de ingineri din domeniul producției (cercetare-dezvoltare, proiectare, fabricație, mentenanță etc.).
Disciplina tratează atât subiectele fundamentale în domeniul calității (concepte, standarde, tehnici si instrumente), cât și subiecte focalizate pe domeniul producției automatizate sau robotizate (ingineria proceselor, lean six sigma, control statistic al proceselor), găsindu-și aplicarea în numeroase industrii: automotive, electronică, farmaceutică, industrii de proces ș.a.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere din nota finală
10.4 Curs	- capacitatea de utilizare a cunoștințelor dobândite în rezolvarea unor probleme și studii de caz	examen oral (C)	66,66%
10.5 Seminar/Laborator /Proiect	- participare la rezolvarea lucrărilor de laborator și prezentarea soluțiilor / rezultatelor	evaluare continuă (L)	33,33%

10.6 Standard minim de performanță:
Notele minime pentru promovare: E≥5, L≥5;
Cele două condiții trebuie să fie satisfăcute simultan.

Data completării:	Titulari	Titlu Prenume NUME	Semnătura
	Curs	Prof.dr.ing. Sorin Popescu	
	Aplicații	Conf.dr.ec. Diana Dragomir	

Data avizării în Consiliul Departamentului

Director Departament,
Prof.dr.ing. Călin Neamțu

Data aprobării în Consiliul Facultății

Decan,
Prof. eng. Stelian BRAD, Ph.D.

FIȘA DISCIPLINEI

1. Date despre program

1.1 Instituția de învățământ superior	Universitatea Tehnică din Cluj-Napoca
1.2 Facultatea	Facultatea de Inginerie Industrială, Robotică și Managementul Producției
1.3 Departamentul	Ingineria proiectării și robotică
1.4 Domeniul de studii	Mecatronică și robotică
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	Robotică (engleză)
1.7 Forma de învățământ	IF - învățământ cu frecvență
1.8 Codul disciplinei	14.00

2. Date despre disciplină

2.1 Denumirea disciplinei				Planificarea producției asistată de calculator	
2.2 Aria de conținut				Disciplină de aprofundare	
2.3 Titularul de curs				Prof.dr.ing. Daniela Popescu - daniela.popescu@muri.utcluj.ro	
2.4 Titularul activităților de seminar / laborator / proiect				Conf.dr-ing.ec. Diana Dragomir - diana.dragomir@muri.utcluj.ro	
2.5 Anul de studiu	2	2.6 Semestrul	1	2.7 Tipul de evaluare	E
2.8 Regimul disciplinei	Categoria formativă				DA
	Opționalitate				DI

3. Timpul total estimate

3.1 Număr de ore pe săptămână	3	din care:	3.2 Curs	2	3.3 Seminar		3.3 Laborator	1	3.3 Proiect	
3.4 Număr de ore pe semestru	42	din care:	3.5 Curs	28	3.6 Seminar		3.6 Laborator	14	3.6 Proiect	

3.7 Distribuția fondului de timp (ore pe semestru) pentru:	
(a) Studiul după manual, suport de curs, bibliografie și notițe	28
(b) Documentare suplimentară în bibliotecă, pe platforme electronice de specialitate și pe teren	11
(c) Pregătire seminarii / laboratoare, teme, referate, portofolii și eseuri	14
(d) Tutoriat	2
(e) Examinări	3
(f) Alte activități:	0

3.8 Total ore studiu individual (suma (3.7(a)...3.7(f)))	58
3.9 Total ore pe semestru (3.4+3.8)	100
3.10 Numărul de credite	4

4. Precondiții (acolo unde este cazul)

4.1 de curriculum	-
4.2 de competențe	-

5. Condiții (acolo unde este cazul)

5.1. de desfășurare a cursului	Online
5.2. de desfășurare a seminarului / laboratorului / proiectului	Onsite; Prezența la activitățile de laborator este obligatorie

6. Competențele specifice acumulate

Competențe profesionale	După parcurgerea disciplinei, studenții vor putea: • să realizeze planificarea producției în funcție de caracteristicile produselor și proceselor vizate; • să determine principalii parametrii care caracterizează performanța sistemelor de producție; • să propună îmbunătățiri ale proceselor și sistemelor de producție.
Competente transversale	Abilități de rezolvare a problemelor tehnice complexe în cadrul sistemelor de producție care utilizează roboți industriali.

7. Obiectivele disciplinei (reieșind din grila competențelor specifice acumulate)

7.1 Obiectivul general al disciplinei	Dobândirea de competențe de planificare a producției în sisteme robotizate sau automatizate
7.2 Obiectivele specifice	Cunoaștere conceptelor, metodelor și tehnicilor utilizate pentru planificarea producției Cunoaștere modelelor de calcul a parametrilor care caracterizează procesele de producție Cunoaștere sistemelor și pachetelor software care susțin activitatea de planificare a producției

8. Conținuturi

8.1 Curs	Nr. ore	Metode de predare	Observații
Sistemele de producție în abordarea Industry 4.0	4	Expunere interactivă Discuții și întrebări	
Tehnologiile IoT și CPS în sistemele de producție I	4		
Tehnologiile IoT și CPS în sistemele de producție II	4		
Planificarea producției cu ajutorul pachetelor PLM I	4		
Planificarea producției cu ajutorul pachetelor PLM II	4		
Sisteme ERP integrate în planificarea producției I	4		
Sisteme ERP integrate în planificarea producției II	4		
Bibliografie 1. Westkämper , E., Spath , D., Constantinescu , C., Lentes , J. (Eds.), Digital production, Springer, 2013 2. Călin Neamțu, Daniela Popescu, Florin Popișter, Module CAD/CAM în Catia V5, Editura Mega, 2013 3. Jörg Thomas Dickersbach, Gerhard Keller, Production planning and control with SAP ERP, 2nd edition, Galileo Press, 2013			
8.2 Seminar / laborator / proiect	Nr. ore	Metode de predare	Observații
Capacitatea și capabilitatea proceselor de producție	2	Elemente multimedia online Exerciții, probleme, studii de caz	
Planificarea în funcție de volumul producției	2		
Aspecte specifice fazei ramp-up	2		
Creșterea productivității proceselor	2		
Calculul costurilor de producție	2		
Impactul fiabilității sistemelor de producție	2		
Reziliența sistemelor de producție	2		
Bibliografie 1. Westkämper , E., Spath , D., Constantinescu , C., Lentes , J. (Eds.), Digital production, Springer, 2013 2. Călin Neamțu, Daniela Popescu, Florin Popișter, Module CAD/CAM în Catia V5, Editura Mega, 2013 3. Jörg Thomas Dickersbach, Gerhard Keller, Production planning and control with SAP ERP, 2nd edition, Galileo Press, 2013			

9. Coroborarea conținuturilor disciplinei cu așteptările reprezentanților comunității epistemice, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului

În cadrul disciplinei Planificarea producției asistată de calculator, masteranzii se familiarizează cu activitățile și provocările generate de prezența sistemelor robotice în cadrul proceselor de producție complexe întâlnite în companiile moderne. Astfel, vor putea aborda probleme specifice care vizează eficacitatea și eficiența integrării roboților cu alte echipamente de producție digitalizate.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere din nota finală
10.4 Curs	Verificarea cunoștințelor teoretice	examen scris (C)	66,66%
10.5 Seminar/Laborator /Proiect	Evaluarea activității la lucrările practice	evaluare continuă (L)	33,34%
10.6 Standard minim de performanță: Notele minime pentru promovare: E≥5, L≥5; Cele două condiții trebuie să fie satisfăcute simultan.			

Data completării:	**Titulari**	**Titlu Prenume NUME**	**Semnătura**
	Curs	Prof.dr.ing. Daniela Popescu	
	Aplicații	Conf.dr-ing.ec. Diana Dragomir	

Data avizării în Consiliul Departamentului

Director Departament,
Prof.dr.ing. Călin Neamțu

Data aprobării în Consiliul Facultății

Decan,
Prof. eng. Stelian BRAD, Ph.D.

MINISTERUL EDUCAȚIEI, CERCETĂRII ȘI INOVĂRII

UNIVERSITATEA TEHNICĂ
DIN CLUJ-NAPOCA

SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Machine Building
1.3	Department	Engineering Design and Robotics
1.4	Field of study	Mechatronics and Robotics
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Robotics
1.7	Form of education	Full time
1.8	Subject code	15.00

2. Data about the subject

2.1 Subject name	**Distributed Control in Robotized Systems**				
2.2 Course responsible/lecturer	conf.dr.ing. Mircea Fulea, mircea.fulea@staff.utcluj.ro				
2.3 Teachers in charge of seminars	conf.dr.ing. Mircea Fulea, mircea.fulea@staff.utcluj.ro				
2.4 Year of study	II	2.5 Semester	1	2.6 Assessment	E
2.7 Subject category	Category				DA
	Optional				DI

3. Estimated total time

3.1 Number of hours per week	3	3.2 of which, course:	2	3.3 applications:	1
3.4 Total hours in the curriculum	100	3.5 of which, course:	28	3.6 applications:	14
Individual study					hours
Manual, lecture material and notes, bibliography					14
Supplementary study in the library, online and in the field					20
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					20
Tutoring					2
Exams and tests					2
Other activities					0

3.7	Total hours of individual study	58
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	

5. Requirements (where appropriate)

5.1	For the course	Slide-show presentation, course support material in electronic format, additional materials on a web site
5.2	For the applications	Attending application classes is mandatory

6. Specific competences

Professional competences	To know: - techniques for modeling the control of a technical process - architectural patterns - basics of ROS (Robot Operating System) - basics of middleware IoT To understand: - concepts related to technical systems architectures - architectural layers of industrial applications - concepts related to distributed control - basic concepts in ROS (Robot Operating System) To do: - install and configure a framework for distributed control of robotized systems - to control actuators and sensors using a distributed control framework - to build a minimal IIoT application
Cross competences	Completing the professional tasks by precisely identifying goals, available resources, constraints, work plan, time span, milestones and deadlines

7 Discipline objectives (as results from the key competences gained)

7.1	General objective	To gain competence for designing distributed control systems în robotized applications.
7.2	Specific objectives	Understanding the concepts related to technical systems architectures Getting familiar with a distributed control framework for robotized applications (Robot Operating System) Getting familiar with a IIoT middleware platform

8 Contents

8.1. **Lecture (syllabus)**		Teaching methods	Notes
1	Introductory aspects	Slideshows, examples, open dialogue Support platform: MS Teams	
2	Technical systems architectures (I)		
3	Technical systems architectures (II)		
4	Distributed control frameworks (I)		
5	Distributed control frameworks (II)		
6	Distributed control frameworks (III)		
7	Distributed control frameworks (IV)		
8	IIoT systems architecture		

9	Middleware IoT (I)		
10	Middleware IoT (II)		
11	ROS: web interfacing (I)		
12	ROS: web interfacing (II)		
13	Reconfigurability (I)		
14	Reconfigurability (II)		
8.2. **Applications**		Teaching methods	Notes
1	Infrastructure for distributed control (Linux distros, virtualization)	Slideshows, examples, specific software tools and hardware platforms Support platform: MS Teams	
2	Distributed control architectures		
3	ROS (Robot Operating System) (I)		
4	ROS (Robot Operating System) (II)		
5	Prototyping of a assembly robotized line control in ROS (1)		
6	Prototyping of a assembly robotized line control in ROS (2)		
7	Prototyping of a assembly robotized line control in ROS (3)		

Bibliography

1. Hochmann, L. - Beyond Software Architecture: Creating and Sustaining Winning Solutions 1st Edition, Addison-Wesley, ISBN 978-020177594
2. Robot Operating System, online at ros.org
3. Kaa, online at kaaproject.org

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

10 Evaluation

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
10.4 Course		Answers to 9 theoretical questions		Written test – 1 hour		25%
10.5 Applications		Aggregate technical report combining all application steps, as performed in the laboratory meetings		Technical report presentation		75%

10.6 Minimum standard of performance
Two correct answers and completion of the technical report

Date of filling in:		**Title, Name, Surname**	**Signature**
	Lectures, applications	conf.dr.ing. Mircea Fulea	

Date of approval in the Engineering Design and Robotics department……. _____	Head of department Prof.dr.ing. Calin Neamtu
Date of approval in the Faculty of Machine Building _____	Dean Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Machine Building
1.3	Department	Engineering Design and Robotics
1.4	Field of study	Mechatronics and Robotics
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Robotics Cluj (English language)
1.7	Form of education	Full time
1.8	Subject code	16.10

2. Data about the subject

2.1	Subject name			Medical Robotics			
2.2	Subject area			DSI, DCA			
2.3	Course responsible/lecturer			Prof. Dr. Eng. Doina Pisla			
2.4	Teachers in charge of seminars						
2.5 Year of study	II	2.6 Semester	1	2.7 Assessment	Exam	2.8 Subject category	DA/DO

3. Estimated total time

3.1 Number of hours per week	3	3.2 of which, course:	1	3.3 applications:	2
3.4 Total hours in the curriculum	42	3.5 of which, course:	14	3.6 applications:	28
Individual study					hours
Manual, lecture material and notes, bibliography					16
Supplementary study in the library, online and in the field					6
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					20
Tutoring					12
Exams and tests					4
Other activities					

3.7	Total hours of individual study	58
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	N/A
5.2	For the applications	N/A

6. Specific competences

Professional competences	To know notions about: -informatics applied in engineering. -advanced robot mechanics. -computer-aided design of mechanical systems. -parameterized design.
Cross competences	**Acquired skills.** The lecture gradually and modularly addresses the main issues regarding medical robotics. The current global trend is to use more and more robots in medicine, allowing doctors to obtain results with much higher accuracy than those obtained by traditional classical interventional and surgical procedures. The introduction of medical robots in pre- and intra-operative procedures, procedures for recovering patients after accidents and neurological diseases, treatment procedures, leads to an increase in the quality of life of the patient. The course deals with different applications of medical robots, as well as the movement planning of medical robots and simulation and command algorithms for different medical applications. After completing the discipline, master students will be able to learn aspects related to the role of medical robots, their simulation and control, methods and techniques used in modelling, simulation and control of medical robots; socio-economic implications related to the use of medical robots; aspects related to the advantages of using parallel robots as medical robots. • Master students will be able to know the current components and trends in the field of medical robots. • To understand the constructive-functional principles of robots and equipment with applications in medicine. • To evaluate the properties and performances of a medical robot. To solve concrete problems related to the development of medical robots starting from specific diseases. **Students will gain**: general knowledge of current technologies for medical robots. Interdisciplinary knowledge and the possibility to know practically the concerns of doctors; experience in the methodology and basic principles that govern research in the field of medical robots. Students will prepare for a successful career in the industry or for a position as a researcher or doctoral student. After completing the discipline students will be able to: • to design and simulate a medical robot starting from the requirements and characteristics imposed by the doctor; • to use mechanical structures together with drive systems and control subsystems to perform medical procedures. • to use different interfaces and control programs of the existing medical robots in the laboratory of parallel robots of the CESTER Research Center; • to create programs to create an interface for modelling and simulation of parallel medical robots. • to determine experimentally the functional characteristics of the medical robots used

	• to know how to analyse the experimental data and to interpret them in the sense of optimizing their functional characteristics.

7. Discipline objectives (as results from the *key competences gained*)

7.1	General objective	Familiarizing students with the development of robotic systems for medical applications
7.2	Specific objectives	Knowledge of robot architecture for medical applications. Presentation and realization of applications for robots used in medicine. Presentation of methods and techniques used in modelling, simulation and control of medical robots; Critical, quantitative and qualitative evaluation based on methods of analysis, planning and selection of robotic systems for medicine. Elaboration of professional and / or research projects for the robotization of some medical applications

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1.	Lecture content. Concepts regarding medical robots. The structure of medical robots. Medical robot applications (serial and parallel robotic structures). Terminology. Getting started. Ethics applied to medical robots. Modelling and simulation of medical robots. Bibliography.	Exposure Discussions	Video-projector
2.	Innovative approaches in surgical robotics. Important stages in the evolution of surgical robotics. Past developments. Current achievements. What does the future of surgical robotics look like? Bibliography.		
3.	PARAMIS parallel medical robot. Structure. Characteristics. Workspace modelling. The experimental model. Bibliography.		
4.	The medical robot PARAMIS 5M_P. Geometric modelling, singularity analysis and analytical workspace generation. The experimental model. Bibliography		
5.	Characteristics of brachytherapy and robotic brachytherapy. The PARA-BRACHYROB robot Characteristics of prostate biopsy and robotic prostate biopsy. The BIO-PROS-1 robot. Bibliography		

6.	New challenges in the field of medical rehabilitation robots. Overview of medical robots used for lower limb rehabilitation. RAISE medical robot. RECOVER Medical robot. Bibliography.		
7.	New challenges in the field of medical rehabilitation robots. Overview of medical robots used for upper limb rehabilitation. ASPIRE medical robot. ParReEx medical robot. Bibliography		
8.2. Applications/Seminars		Teaching methods	Notes
1.	Objectives of laboratory works. Presentation of the topic of laboratory works. The structure of medical robots. Terminology. Presentation of laboratories CESTER Research Center, labour protection measures. Establishing the degree of mobility of medical robots according to the requirements of the medical act.	Applications	Computer, software, robots, video projector.
2.	Presentation of computer hardware and software structures used for modelling and simulation of medical robots. Basic concepts. Applications.		
3.	MATLAB environment. Getting started. MATLAB applications in the field of medical robots.		
4.	MATLAB environment. Instructions and graphical representations. MATLAB applications in the field of medical robots.		
5.	PARASURG-5M parallel medical robot. Determining the workspace and the singularities of Matlab Programs. Description of the command interface. Practical operation of the robot for students.		
6.	Parallel medical robot PARAMIS_5M_P. Matlab programs presented for determining the workspace and singularities. Control and actuation modes. Description of the command interface. Practical operation of the robot for students.		
7.	Modelling and experimental testing of the PARASURG-9M robotic system. 3D model of the PARASURG-9M robotic arm. Kinematic and dynamic modelling and simulation of the PARASURG-9M robotic system. Presentation of the control program. Experimental tests. Practical operation of the robot for the student.		
8.	Presentation of medical robots for cancer therapy. Individual applications. Practical operation of the robot for the student.		

9.	Presentation of medical robots for diagnosing prostate cancer. Individual application. Practical operation of the robot for the student.		
10.	Presentation of upper limb recovery robots for patients who have suffered a stroke. Individual application. Practical operation of robots for the student.		
11.	Presentation of lower limb recovery robots for patients who have suffered a stroke. Individual application. Practical operation of robots for the student.		
12.	Kuka iiwa LBR 7 R800 collaborative robot with medical applications. Description of the components of the robotic system. Presentation of the robot programming mode. Practical application.		
13.	ABB YuMi collaborative robot with medical applications. Presentation of the components of the robotic recovery system. Presentation of the robot programming mode. Practical application.		
14.	ProHep-LCT robotic system for laparoscopic treatment of liver cancer. Presentation of the kinematic structure. Presentation of the graphical interface and the control system. Practical application.		

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3. Vaida, Calin., Pisla, Doina, Programarea calculatoarelor, Vol. I Utilizarea calculatoarelor. Aplicaţii, serie coordonată de Prof. D. Pisla, Ed. Mediamira, Cluj-Napoca, 2008, ISBN – 978-973-713-247-5
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1. Vanja Bozovic „Medical Robotics", I-Tech Education and Publishing, Vienna, January 2008.
2. Rosen, Jacob; Hannaford, Blake; Satava, Richard M. (Eds.), Surgical Robotics, Systems Applications and Visions, 1st Edition., Springer, 2011.
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4. Scweikard A, Ernst, F., Medical Robotics, Springer, 2015.
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6. Siciliano, B., Khatib, O., Handbook of Robotics, Springer, 2008.
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14. Vaida, Calin, Gherman, Bogdan, Pisla, Doina, Programarea calculatoarelor, Vol. III, Programare in MATLAB pentru ingineri, serie coordonată de Prof. D. Pisla, Ed. Mediamira, Cluj-Napoca, 2014, ISBN- 978-973-713-312-0
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18. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, Robot Modeling and Control, First Edition, JOHN WILEY & SONS, INC., 2005.
19. Popovic, M.B., Biomechanics and Robotics, Pan Stanford Publishing, 2013.
20. Troccaz, J. Medical Robotics, Willey, 2012.
21. Van Wynsberghe, A, Healthcare Robts Ethics, Design and Implementation, Routledge, 2013.
22. Shahinpoor, M., Gheshmi, S., Robotic Surgery , Smart Materials, Robotic Structures and Artificial Muscles, Pan Stanford Publishing, 2015.
23. Xie, S. Advanced Robotics for Medical Rehabilitation, Current State of the Art and Recent Advances, Sprinfer, 2016.
24. DELTALAB, Documentatie tehnica platforma Stewart, 2004.
25. *** Matlab, Mathworks Inc.
26. *** Solid Edge, Siemens PLM.
27. *** NX, Siemens PLM.
28. *** Force Dimension.
29. *** www.mscsoftware.com/products/adams.cfm

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

Master students will prepare for a successful career in the industry or for a position as a researcher or doctoral student. The acquired skills will be necessary for the employees who will carry out their activity within the specialized robot companies and the medical equipment companies.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
Course	Checking knowledge through problem solving and a theory part (10 questions)	Written exam (1.5-2 hours)	70%
Applications	Creating an application in a specialized software	Practical exam (2 hours)	30%
10.4 Minimum standard of performance			
Practical application solved and right answer of 5 questions			

Date of filling in

Lecturer
Prof.dr. ing. Doina Pisla

Teachers in charge of seminars
Prof.dr. ing. Doina Pisla

SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Industrial Engineering, Robotics, and Management of Production
1.3 Department	Design Engineering and Robotics
1.4 Field of study	Mechatronics and Robotics
1.5 Cycle of study	Master
1.6 Program of study/Qualification	Robotics
1.7 Form of education	Full time
1.8 Subject code	17.10

2. Data about the subject

2.1 Subject name	***Vision systems in robotics***				
2.2 Course responsible/lecturer	Assoc. prof. dr. eng. Tiberiu Marita - Tiberiu.Marita@cs.utcluj.ro				
2.3 Teachers in charge of seminars/ laboratory/ project	Assoc. prof. dr. eng. Tiberiu Marita - Tiberiu.Marita@cs.utcluj.ro				
2.4 Year of study	II	2.5 Semester	I	2.6 Type of assessment (E - exam, C - colloquium, V - verification)	C
2.7 Subject category	Formative category				DA
	Optionality				DO

3. Estimated total time

3.1 Number of hours per week	2	of which:	Course	1	Seminars	-	Laboratory	1	Project	0
3.2 Number of hours per semester	28	of which:	Course	14	Seminars	-	Laboratory	14	Project	0
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										28
(b) Supplementary study in the library, online and in the field										26
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										14
(d) Tutoring										0
(e) Exams and tests										4
(f) Other activities:										0

3.4 Total hours of individual study (suma (3.3(a)...3.3(f)))	72
3.5 Total hours per semester (3.2+3.4)	100
3.6 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	N/A
4.2 Competence	Matlab Programming, Linear Algebra and Analytical Geometry,, Physics (Optics)

5. Requirements (where appropriate)

5.1. For the course	Graphic tablet / tablet, projector, computer, e-learning platforms
5.2. For the applications	Computers, specific software (Matlab or Octave), e-learning platforms

6. Specific competence

Professional competences	• Understanding and using the concepts, paradigms and models of artificial vision applied in robotics, selection and use of artificial vision systems in robotics. • Use of specific development media for creating and testing client-server applications in communication and interface with industrial robots and robotic systems in general, use of image processing media in robotics. • Integrated application of advanced software environments for the development of intelligent human-robot interfaces, including interfaces based on artificial vision. • Critical, quantitative and qualitative evaluation based on methods of analysis, planning and selection of intelligent interfacing solutions for robot operators or robots with the working environment. • Elaboration of professional and / or research projects for the realization of human-robot, robot-robot, robot-work environment communication interfaces
Cross competences	• To apply the values and ethics of the engineering profession. • To perform responsibly complex professional tasks in conditions of professional autonomy and independence. • To promote logical, convergent and divergent reasoning, practical applicability, evaluation and self-evaluation in decision making. • Plan your own work priorities. • To self-control the learning and effective use of language skills and knowledge of information and communication technology.

7. Discipline objective (as results from the *key competences gained*)

7.1 General objective	• Understanding the fundamental concepts related to images, artificial vision and image processing. Learning and using the fundamental methods of image processing and artificial vision in the design of specific applications for robotics.
7.2 Specific objectives	• Knowledge, evaluation and use of concepts, algorithms and methods specific to artificial vision: digital image representation formats, camera model, statistical analysis, filtering, quality improvement / restoration, segmentation, photogrammetry, stereovision. • Developing the ability to find optimal implementation solutions in terms of time and resources • Development of capacities for qualitative and quantitative evaluation of results, algorithms and vision systems for robotics • Know and use specific programming / processing tools (Matlab / Octave)

8. Contents

8.1 Lectures	Hours	Teaching methods	Notes
Introductory notions	1	Orally and with multimedia or e-learning, interactive teaching style, consultation, student involvement in problem solving	N/A
Digital image representation model. The process of forming and acquiring digital images.	1		
Camera model. Camera calibration.	1		
Basic notions of stereovision.	1		
Statistical properties of grayscale images and applications.	1		
Image filtering / spatial filters	1		
Modeling and elimination of noise	1		
Edge detection / segmentation based on discontinuities	1		
Detection of points of interest (corners)	1		
Determining connected components / labeling objects in binary images	1		
Detection and tracking of the contours of binary objects	1		
Calculation of the geometric properties of binary objects	1		
Morphological operations and applications	1		
Examples of solving complex vision problems with applications in robotics	1		

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1. R.C.Gonzales, R.E.Woods, *Digital Image Processing – 2-nd Edition*, Prentice Hall, 2002.

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3. W.K. Pratt, *Digital Image Processing: PIKS Inside, 3-rd Edition,* Wiley & Sons 2001.
4. G. X.Ritter, J.N. Wilson, Handbook of computer vision algorithms in image algebra - 2nd ed, CRC Press, 2001.
5. Frank Y. Shih, *Image Processing And Pattern Recognition - Fundamentals and Techniques*, Wiley & Sons, Hoboken, New Jersey, 2010.
6. S. Nedevschi, R. Dănescu, F. Oniga, T. Mariţa*, Tehnici de viziune artificială aplicate în conducerea automată a autovehiculelor,* Editura U.T. Press, Cluj-Napoca, 2012.

Virtual teaching materials:

1. T. Marita, R. Danescu, „Sisteme de viziue in robotica", Note de curs si laborator: http://users.utcluj.ro/~tmarita/SVR/
2. T. Marita, "Prelucrarea imaginilor - Note de curs", http://users.utcluj.ro/~tmarita/IPL/IPCurs.htm

8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Introduction to the Matlab or Octave environments and related image processing tools: image display and visualization, image format conversions	2	Presentation on the board and with multimedia or e-learning tools Experiments and implementation using specific tools (Matlab/Octave, Image Processing Toolbox) Evaluation of the implementation stages	N/A
Implementation of simple processing on intensity images: brightness / contrast modification, quality improvement.	2		
Implementation of simple operations on binary images: morphological operations, labeling, computation of simple geometric properties	2		
Shape recognition: objects segmentation	2		
Shape recognition: extracting of simple features for the segmented objects	2		
Shape recognition: classifying objects based on simple features	2		
Shape recognition: displaying / visualizing of the results	2		

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1. R.C.Gonzales, R.E.Woods, S.L. Eddins, Digital Image Processing Using MATLAB, *Gatesmark Publishing*, 2nd Edition, 2009.
2. A. McAndrew, An Introduction to Digital Image Processing with MATLAB, Notes for SCM2511 Image Processing, 2004, School of Computer Science and Mathematics, Victoria University of Technology.
3. C. Solomon, T. Beckon, Fundamentals of digital image processing - a practical approach with examples in Matlab, *Wiley & Sons*, 2011.

Virtual teaching materials:

1. T. Marita, R. Danescu, „Sisteme de viziue in robotica", Lucrari de laborator: http://users.utcluj.ro/~tmarita/SVR/

** It will be specified, as the case may be: the theme of the seminars, the laboratory works, the theme and the stages of the project.*

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

The discipline is part of the field of Mechatronics and Robotics, its content combining fundamental aspects with practical aspects used in the field of visual information processing. The activities carried out within the discipline familiarize the students with the basic theoretical and applied aspects that allow the approach of some simple problems of the artificial vision with applicability in robotics. The content of the discipline is corroborated with the specific curricula of other universities in the country and abroad, benefiting from the experience in the field (recognized by the international community) of the members of the discipline team.

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Testing knowledge and problem solving skills	Written and / or oral colloquium. If face-to-face examination is not possible, the examination will be conducted using e-learning platforms such as MS Teams	50%

Laboratory	Practical problem solving and implementation skills and specific application design. Presence and activity	Continuous evaluation of the activity, In case the face-to-face evaluation of the laboratory activity is not possible, e-learning platforms such as MS Teams will be used.	50%
Minimum standard of performance: Modeling and implementation of typical engineering problems using the formal apparatus characteristic of the field. Discipline grade calculation: 50% Laboratory + 50% Colloquium Conditions for participation in the final exam: Laboratory ≥ 5 Promotion conditions: Final exam ≥ 5			

Date of filling in:	**Titulari**	**Title First Name NAME**	**Signature**
	Course	Assoc.prof.dr.eng. Tiberiu MARIŢA	
	Applications	Assoc.prof.dr.eng. Tiberiu MARIŢA	

Date of approval in the department	Head of department Prof. dr. ing. Călin NEAMȚU
Date of approval in the Faculty Council	Dean Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Information about the program of study

1.1 Institution	Technical University of Cluj Napoca
1.2 Faculty	Industrial Engineering, Robotics and Production Management
1.3 Department	Engineering Design and Robotics
1.4 Field of study	Robotics and Mechatronics
1.5 Cycle of study	Master's degree
1.6 Program of study/Qualification	Robotics
1.7 Form of education	Full time
1.8 Subject code	17.20

2. Information about the subject

2.1 Subject name			Calibration and Accuracy of Industrial Robots		
2.2 Course responsible/Lecturer			*Assoc. Prof. Eng. Crișan Adina Veronica, PhD, adina.crisan@mep.utcluj.ro*		
2.3 Teachers in charge with seminars/projects/laboratory			*Assoc. Prof. Eng. Crișan Adina Veronica, PhD, adina.crisan@mep.utcluj.ro*		
2.4 Yaer of study	2	2.5 Semester	1	2.6 Assessment	C
2.7 Subject category	Formative				DA
	Optional				DO

3. Estimated total time

3.1 Number of hours / week	2	Of which:	3.2 Course	1	3.3 Seminary	0	3.3 Laboratory	1	3.3 Project	0
3.4 Total hours in the curriculum	28	Of which:	3.5 Course	14	3.6 Seminary	0	3.6 Laboratory	14	3.6 Project	0
3.7 The distribution of total hours / semester:										
(a) Manual, lecture material and notes, bibliography										20
(b) Supplementary study in the library, online and in the field										20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										20
(d) Tutoring										
(e) Assessment										4
(f) Other activities:										8

3.8 Total hours of individual study	72
3.9 Total hours/semester	100
3.10 Credit points	4

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	To possess knowledge, acquired within the undergraduate studies and at the disciplines: Applied Mathematics; Computer Programming and Use; Applied Mechanics; Robot mechanics, Acquisition and measurement systems, Vibromechanics of systems, Planning the trajectories for industrial robots.

5. Requirements (where appropriate)

5.1. For the course	N / A
5.2. For the applications	• Attendance to laboratory activities and carrying out the laboratory works is mandatory

6. Specific competences

Professional competences	**After completing the discipline students will be able to:** • Perform the step-by-step robot calibration process. • To identify certain dynamic parameters of the manipulators based on the measurements in dynamic regime. • To identify the dynamic parameters of the manipulator structure through experimental modal analysis. • To generate and program precision trajectories in the configuration space and in the Cartesian space. • To analyze the performances regarding the kinematic and dynamic precision of the robots implemented in technological processes. • Use the industry standards.
Cross competences	Continuous training and efficient use of information and communication resources (Internet portals, specialized software applications, databases, online courses, etc.). • Know the equipment / devices used to calibrate the robots. • To use the computer for the optimal planning of the precision trajectories of the robots. • To use the equipment related to the operation and control of the robots implemented in various technological processes.

7. Discipline objectives (as results from the *gained key competences*)

7.1 General Objective	Acquiring information related to kinematic and dynamic modeling of the accuracy in case of industrial robots and those related to the implementation of the kinematic calibration process for different serial robot structures.
7.2 Specific objectives	• Understand and master the steps of dynamic calibration. • To evaluate the performances that characterize the kinematic and dynamic precision in robotics. • Understand the principles of precision optimization. • Synthesize the information regarding calibration and accuracy of robots implemented in technological processes.

8. Contents

8.1 Lectures (syllabus)	No. of hours/week	Teaching methods	Notes
1. Introduction to the study of accuracy. Fundamental notions.	2	In the teaching process classical methods (exposure to the blackboard) combined with new methods that use media equipment and tools are to be used.	The course activities are carried out for 1 hour / week
2. Advanced modeling algorithms in robotics. Kinematic control functions. Dynamic control functions.	2		
3. Accuracy algorithms in robotics	2		
4. Advanced robot positioning and orientation algorithms. Algorithms for modeling the kinematic accuracy of robots.	2		
5. Methods for estimating robot accuracy. The influence of dynamic errors on the accuracy of motion trajectories	2		
6. Notions regarding robot calibration	2		
7. Calibration methods and tools in robotics	2		

Bibliography
1. M. Abderrahim, A. Khamis, S. Garrido and Luis Moreno . *Accuracy and Calibration Issues of Industrial Manipulators*, Industrial Robotics: Programming, Simulation and Applications, Low Kin Huat (Ed.), ISBN: 3-86611-286-6, Publisher Pro Literatur Verlag, Germany / ARS, Austria, 2006
2. Bernhardt, R., Albright, S.L., *Robot Calibration*, Chapman & Hall. ISBN 0-412-491-40-0, 311 p.
3. Borm, J.H, Meng, C.H., *Experimental Study of Observability, of Parameter Errors in Robot Calibration.* Arizona : IEEE Scottsadale, Proceedings of IEEE International Conference on Robotics and Automation, pg. 587 – 592, 1989.
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8. Mekid, S., *Introduction to Precision Machine Design and Error Assessment, CRC Press*, 2008.
9. Negrean, I., Forgo, Z., *Inverse Modelling of the Dynamic Errors of Robots*, INES'98, IEEE International Conference on Intelligent Engineering Systems, Proceedings, Vienna, Austria, September 1998, pp.457-462.
10. Negrean, I., Albeţel, D.G., *The Generalized Matrices in the Robot Accuracy,* Conferinţa ştiintifică Internaţională TMCR 2003, Chişinău, 2003, Vol.3, ISBN 9975-9748-3-X.
11. Negrean, I., *Kinematics and Dynamics of Robots .Modelling, Experiment, Accuracy*, Editura Didactică şi Pedagogică, Bucureşti, 1999.
12. Negrean, I., *Mecanică avansată în Robotică*, Editura UT Press Cluj-Napoca, 2008.
13. Steven M. LaValle, *Planning Algorithms*, Published by Cambridge University Press, 2006.

8.2 Applications	Teaching methods	Notes
1. Determining of position and orientation errors	Laboratory works are carried out as mini projects that the master students must complete by until the last meeting. Along the way, examples will be presented. The students can use these examples to solve specific problems.	The laboratory activity is carried out in groups, the meetings taking place on the date set in the schedule.
2. Determining of kinematic errors		
3. Determining of dynamic errors		
4. Calibration of a robot with serial structure		
5. Calibration of a robot with serial structure		
6. Optimal design of the accurate trajectory, for the FANUC I robot.		
7. Optimal design of the accurate trajectory, for the FANUC II robot.		

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

- It is carried out through regular discussions scheduled by the faculty with representatives of employers

10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Share in the final grade
10.4 Course	The level of understanding the notions regarding the accuracy and calibration in robotics as well as the adequate understanding of the studied algorithms.	Written and oral examination (theory and applications): in writing for 2 hours, followed by a presentation on a imposed topic.	75%
10.5 Applications	Ability to apply the learned concepts in solving some problems.	The reports are appreciated and noted if they are delivered on time. It is valued with a grade between 1 and 10	25%

10.6 Minimum standard of performance
• To pass the exam, the students have to provide satisfactory solution to the application and correct answer to a theory subject.

Filling in date:	**Lecturer**	**Scientific title/Surname NAME**	**Signature**
	Course	Assoc. Prof. Eng. Adina – Veronica CRIȘAN	
	Applications	Assoc. Prof. Eng. Adina – Veronica CRIȘAN	

Date of approval in the Department _____	Head of Department, Prof.dr.ing.
Date of approval in the Faculty Council _____	Decan, Prof. eng. Stelian BRAD, Ph.D.

SYLLABUS

1. Information about the program

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Industrial Engineering, Robotics an Manufacturing Management
1.3 Department	Department of Modern Langages and Communication
1.4 Study area	Industrial Engineering
1.5 Study cycle	Master
1.6 Study program/ Qualification	IVFC en., Ro en.
1.7 Form of education	IF – full time attendance
1.8 Discipline code	18.00

2. Information about the discipline

2.1 Name of discipline				Ethics and academic integrity	
2.2 Content area					
2.3 Professor				Associate Professor, Ph.D. Căpraru Angelica Angelica.Capraru@lang.utcluj.ro	
2.4 Teaching Assistant for seminar/laboratory/project				-	
2.5 Academic year		2.6 Semester		2.7 Type of evaluation	C
2.8 Discipline classification	Formative category				DC
	Optional category				DI

3. Time allocated

3.1 Number of hours per week	1	including:	3.2 Lecture	1	3.3 Seminar		3.3 Laboratory		3.3 Project	
3.4 Number of hours per semester	14	including:	3.5 Lecture	14	3.6 Seminar		3.6 Laboratory		3.6 Project	

3.7 Distribution total time (hours per semester) of individual learning activities	
(a) Study (manual, course support, bibliography, course notes)	10
(b) Supplementary study (library, e-platforms, field study)	10
(c) Preparation of homework, practical assignments, exercises	16
(d) Tutorials	
(e) Examination	2
(f) Other:	

3.8 Total number of hours of individual study (sum of (3.7(a)...3.7(f)))	36
3.9 Total number of hours per semester (3.4+3.8)	14
3.10 Number of credits	2

4. Preconditions (where appropriate)

4.1 Curriculum	Not applicable
4.2 Competencies	Not applicable

5. Teaching facility (when it applies)

5.1. Course progress	
5.2. Applications progress (seminar/laboratory/project)	

6. Specific competencies

Professional competencies	Knowledge of the fundamental notions in the field of academic ethics, understanding, internalization and their application in academic activities; Knowledge of the explicit or implicit norms that regulate the academic conduct of the intellectual work of the students of UTCN; Use of conceptual "tools" to solve ethical and moral dilemmas; The ability to analyze ethical dilemmas and identify possible solutions; Identification of interdisciplinary connections.
Transversal competencies	TC1 Applying the values and ethics of the engineering profession, knowing the strategies and techniques / tactics of oral and written communication, promoting the argumentative, convergent and divergent logical reasoning in the knowledgeable and responsible execution, of the professional tasks. TC2 Responsible execution of work tasks in a multidisciplinary team, assuming roles at different hierarchical levels.

7. Course objectives (based on the grid of specific competencies)

Overall objective of the course	The course aims to analyze the fundamental problems, at the theoretical and applicative level, related to the academic ethics, in order to develop the ethical competence of the students, to form an upright behavior from the academic point of view, which will be the basis of a responsible professional career.
Specific objectives	Development of skills needed to identify and solve ethical problems; Development and formation of scientific research skills in the field of engineering; Knowledge and assimilation of the legislation that regulates the academic conduct; Compliance and application of knowledge gained in the academic work.

8. Content

8.1 Course	Hours	Teaching methods	Observations
1. The object and issues of ethics: conceptual delimitations Interdisciplinary approaches *Defining and interpreting the basic concepts of academic ethics. Glossary of terms*	2	Lecture, exposition, heuristic conversation, debate	The course is carried out online, on MS Teams platform. Internet connection, microphone and camera.
2. Academic responsibilities and rights *University code of the rights and obligations of the student from UTCN.* *Social effects of lack of academic honesty* *Case studies*	2		
3. The ethics of scientific research. Principles, problems, solutions *Standards and regulations of the academic environment regarding good conduct in scientific research* *Copyright and related rights*	2		
4. Good practice in writing a scientific paper *Citation rules* *Corrections of fair conduct regarding the use of data* *Criteria for establishing originality in research*	2		

5. Plagiarism and self-plagiarism *Types of plagiarism* *Plagiarism procedures. Electronic means of identifying plagiarism*	2		
6. Other forms of academic dishonesty: consequences and sanctions *Data forgery, ghostwriting, honorary authorship, etc.* *Counterproductive behaviors and attitudes*	2		
7. Case studies: dilemmas and problems Discussion topic: examples of "bad practices" in research	2		

Bibliography

Learning materials and bibliography will be available on MSTeams class.

Consiliul Naţional de Etică a Cercetării Ştiintifice, Dezvoltării Tehnologice şi Inovării (CNECSDTI),*Ghid de integritate în Cercetarea Ştiinţifică*, 2020. Accesat la data de 30 ianuarie 2021.

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***Ghidul Harvard University Disponibil la : http://isites.harvard.edu/icb/icb.do?keyword=k70847&pageid=icb.page342054), În variant tradusă (http://www.criticatac.ro/17313/reguli-antiplagiat-harvard/ Accesat la data de 9 septembrie 2018.

*** Legea 206/2004 privind buna conduită în cercetarea științifică, dezvoltarea tehnologică și inovare. Disponibil la https://lege5.ro/Gratuit/gu3donrv/legea-nr-206-2004-privind-buna-conduita-in-cercetarea-stiintifica-dezvoltarea-tehnologica-si-inovare Accesat la data de 5 septembrie 2018.

9. Correlation between syllabus and needs and expectations of the professional associations and business community

The content of the discipline corresponds to the thematic areas in the field approached nationally and internationally at this level of studies.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation type	10.3 Proportion of the final grade (%)
10.4 Course		Written test	100%
10.5 Seminar/Laboratory/ Project			
10.6 Minimum performance standards A minimum grade 5 is required.			

Filling date:	**Holders**	**Title First Name Surname**	**Signature**
	Course	Associate Professor, Ph.D. Căpraru Angelica	
	Applications	-	

Date of validation in the Department Council	Head of departament Assoc. Prof., Ph.D. Ruxanda Literat
Date of validation in the Faculty Council	Dean Prof. eng. Stelian BRAD, Ph.D.