DEPARTMENT OF ROBOTICS AND INTELLIGENT SYSTEMS ENGINEERING

Course Details				
Code	**Academic Year**			**Semester**
RIS514	1			2
Title	**T**	**A**	**L**	**ECTS**
Robot Control	3	0	0	7

Language	English					
Level	**Undergraduate**		**Graduate**	x	**Postgraduate**	
Department / Program	Robotics and Intelligent Systems					
Forms of Teaching and Learning	Formal					
Course Type	**Compulsory**		**Elective**	x		
Objectives	To introduce the fundamental control theory and control methods to students. To teach students how to apply various control approaches to robotic systems.					
Content	Introduction to the control theory. Linear control. Nonlinear control. Force control. Admittance control. Control applications of various robotic systems using MATLAB. Classical Control Application: PID, Robust Control Application: Sliding Mode Control, Intelligent Control Application: Fuzzy Logic Control.					
Prerequisites						
Coordinator						
Lecturer(s)	Assoc.Prof.Dr. Yunus Ziya ARSLAN					
Assistant(s)						
Work Placement						

Recommended or Required Reading	
Books / Lecture Notes	Craig, John J. Introduction to robotics: mechanics and control, 3/E. Pearson Education India, 2009. Arslan, Yunus Ziya, Yuksel Hacioglu, Yener Taskin, and Nurkan Yagiz. "Control of a Biomimetic Robot Hand Finger: Classical, Robust, and Intelligent Approaches." In Handbook of Research on Advancements in Robotics and Mechatronics, pp. 475-499. IGI Global, 2015.
Other Sources	1. Yagiz, N., Arslan, Y.Z., Hacioglu, Y., 2007, Sliding mode control of a finger for a prosthetic hand , Journal of Vibration and Control, 13(6), 733-749. 2. Arslan, Y.Z., Yagiz, N., Hacioglu Y., 2008, Prosthetic hand finger control using fuzzy sliding modes , Journal of Intelligent and Robotic Systems, 52(1), 121-138. 3. Hacioglu, Y., Arslan, Y.Z., Yagiz, N., 2008, PI+PD type fuzzy logic controlled dual-arm robot in load transfer, Strojniski Vestnik - Journal of Mechanical Engineering, 54(5), 347-355.

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	4. Arslan, Y.Z., Hacioglu, Y., Yagiz, N., 2009, Fuzzy sliding mode control of a humanoid robot hand finger, Expert Systems, 26(3), 291-303.
Additional Course Material	
Documents	
Assignments	Homeworks, projects and technical readings on robot control.
Exams	

Course Composition		
Mathematics und Basic Sciences		%20
Engineering		%60
Engineering Design		%20
Social Sciences		%
Educational Sciences		%
Natural Sciences		%
Health Sciences		%
Expert Knowledge		%

Assessment		
Activity	**Count**	**Percentage (%)**
Midterm Exam	1	25
Quiz		
Assignments	5	15
Attendance		
Recitations		
Projects	1	20
Final Exam	1	40
	Total	**100**

ECTS Points and Work Load			
Activity	**Count**	**Duration**	**Work Load (Hours)**
Lectures	14	2	28
Self-Study	14	7	98
Assignments	5	5	25
Presentation / Seminar Preparation			
Midterm Exam	1	2	2
Recitations	14	2	28
Laboratory			
Projects	1	10	10
Final Exam	1	2	2

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Total Work Load	**195**
ECTS Points (Total Work Load / Hour)	**7**

Learning Outcomes	
1	To be able to control a robot with sufficient accuracy
2	To be able to implement various control methods to a robotic system
3	To be able to control the desired trajectory of a robotic system
4	To be able to control the force applied by a manipulator (or robot end effector) to an object or environment.
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Weekly Content	
1	Introduction to Control Theory: Linear State-Variable Systems
2	Introduction to Control Theory: Nonlinear State-Variable Systems
3	Linear Control
4	Linear Control
5	Nonlinear Control
6	Nonlinear Control
7	Force Control
8	Force Control
9	Admittance Control
10	Control applications of various robotic systems using MATLAB. Classical Control Application: PID
11	Control applications of various robotic systems using MATLAB. Robust Control Application: Sliding Mode Control
12	Control applications of various robotic systems using MATLAB. Robust Control Application: Sliding Mode Control
13	Control applications of various robotic systems using MATLAB. Intelligent Control Application: Fuzzy Logic Control
14	Control applications of various robotic systems using MATLAB. Intelligent Control Application: Fuzzy Logic Control
15	

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Contribution of Learning Outcomes to Program Objectives (1-5)							
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**
1							
2							
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12							

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
Compiled by:	Assoc.Prof.Dr. Yunus Ziya ARSLAN
Date of Compilation:	27.01.2021