

DEPARTMENT OF ROBOTICS AND INTELLIGENT SYSTEMS ENGINEERING

Course Details				
Code	Academic Year			Semester
RIS516	1			1
Title	T	A	L	ECTS
Smart Metarials	3	0	0	7
Language	English			
Level	Undergraduate	Graduate	✓	Postgraduate
Department / Program	Robotics and Intelligent Systems			
Forms of Teaching and Learning	Formal			
Course Type	Compulsory		Elective	✓
Objectives	<p>On successful completion of this course, students will be able to:</p> <ul style="list-style-type: none"> • Understand the concept of smart materials and smart structures • Develop familiarity with piezoelectric materials and their use as sensors and actuators in various configurations • Develop familiarity with shape-memory alloys • Knowledge of various other smart materials/structures with application examples • Read and understand emerging technical literature about the subject 			
Content	<ul style="list-style-type: none"> • A general overview of smart materials • Review of basic mechanical and electrical concepts • Piezoelectric and Electrostrictive Transducers • Shape-memory alloys and their Applications • Magnetostrictive and Magnetoelectric Materials • Thermoelectric Materials and Actuators • Electroactive polymers 			
Prerequisites				
Coordinator				
Lecturer(s)	Asst. Prof. Dr. –Ing. Abdulkadir ŞANLI / Asst. Prof. Dr. –Ing. Çağatay ELİBOL			
Assistant(s)				
Work Placement				
Recommended or Required Reading				
Books / Lecture Notes	<ul style="list-style-type: none"> • Filimon, Anca, ed. Smart Materials: Integrated Design, Engineering Approaches, and Potential Applications. CRC Press, 2018. • Schwartz, Mel, ed. Smart materials. CRC press, 2008. • Gandhi, Mukesh V., and B. D. Thompson. Smart materials and structures. Springer Science & Business Media, 1992. 			
Other Sources				
Additional Course Material				
Documents				

DEPARTMENT OF ROBOTICS AND INTELLIGENT SYSTEMS ENGINEERING

Assignments	Homeworks and technical readings on smart materials		
Exams			
Course Composition			
Mathematics und Basic Sciences			%15
Engineering			%60
Engineering Design			%20
Social Sciences			%
Educational Sciences			%
Natural Sciences			%5
Health Sciences			%
Expert Knowledge			%
Assessment			
Activity	Count	Percentage (%)	
Midterm Exam	1	30	
Quiz			
Assignments	5	10	
Attendance			
Recitations			
Projects			
Final Exam	1	60	
		Total	100
ECTS Points and Work Load			
Activity	Count	Duration	Work Load (Hours)
Lectures	14	2	28
Self-Study	14	10	140
Assignments	5	5	25
Presentation / Seminar Preparation			
Midterm Exam	1	2	2
Recitations	14	2	28
Laboratory			
Projects			
Final Exam	1	2	2
		Total Work Load	225
		ECTS Points (Total Work Load / Hour)	7
Learning Outcomes			

DEPARTMENT OF ROBOTICS AND INTELLIGENT SYSTEMS ENGINEERING

1	Ability to understand basic mechanical and electrical properties of materials within the frame of robotic
2	Capable of understanding materials based on piezoelectric materials
3	Ability to design sensors & actuators for robotic applications using shape memory alloys
4	Capable to design sensors & actuators based on magnetostrictive and magnetoelectric materials
5	Ability to understand magnetostrictive and magnetoelectric materials and design sensors & actuators based on them
6	Ability to understand thermoelectric materials and use them for possible robotic projects
7	Having the ability to interpret emerging technical literature related to smart materials
8	
9	
10	
11	
12	

Weekly Content

1	General Introduction to Smart Materials
2	Review of Basic Mechanical and Electrical Concepts of Smart Materials
3	Review of Basic Mechanical and Electrical Concepts of Smart Materials
4	Piezoelectric and Electrostrictive Transducers/ Actuators
5	Piezoelectric and Electrostrictive Transducers/ Actuators
6	Shape Memory Alloys, Ferromagnetic SMA and Their Potential Applications
7	Shape Memory Alloys, Ferromagnetic SMA and Their Potential Applications
8	Midterm Exam
9	Basic Concept and Applications of Magnetostrictive and Magnetoelectric Materials
10	Basic Concept and Applications of Magnetostrictive and Magnetoelectric Materials
11	Temperature Sensors/ Thermoelectric Materials Alloys Actuators
12	Basic Concept and Design of Electroactive polymers and their applications
13	Basic Concept and Design of Electroactive polymers and their applications
14	Carbonaceous based Smart Materials and Their Applications
15	Carbonaceous based Smart Materials and Their Applications

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	P2	P3	P4	P5	P6	P7
1	5	5	3	3	4		
2	4	4	5	4	4		
3	5	4	4	5	4		

DEPARTMENT OF ROBOTICS AND INTELLIGENT SYSTEMS ENGINEERING

4	4	5	4	5	4		
5	5	5	5	5	3		
6	4	4	4	5	4		
7	4	4	5	5	5		
8							
9							
10							
11							
12							

Contribution Level 1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High

Compiled by: Asst. Prof. Dr.-Ing. Abdulkadir ŞANLI

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