

ROBOTICS AND INTELLIGENT SYSTEMS MASTER PROGRAM COURSE SYLLABUS

| 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 | | | | |

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| | | | |
|------------------------------------|---|---|-------------------|
| 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 | | | |

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| | |
|----|---|
| 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 | | |

**ROBOTICS AND INTELLIGENT SYSTEMS MASTER PROGRAM
COURSE SYLLABUS**

| | | | | | | | |
|----|---|---|---|---|---|--|--|
| 3 | 5 | 4 | 4 | 5 | 4 | | |
| 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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