

School of Engineering and Computer Science
Mech 405: Introduction to Microcontrollers

Catalog Data:	Mech 405 Introduction to Microcontrollers; 3 credits Microcontroller architecture, microcontroller programming, mechanical system design with embedded microcontrollers.
Class Schedule:	Three 50-minute lectures per week, for one semester.
Laboratory Schedule:	Lecture sessions converted into laboratory sessions as needed for demonstrations and hands-on activities.
Prerequisites by Course:	CS 251, Mech 304
Prerequisites by Topic:	<ol style="list-style-type: none"> 1. Basic electrical circuits knowledge 2. Basic understanding of computer programming (preferably knowledge of C programming language) 3. Understanding of transducers and hardware interfacing
Required Texts:	Han-Way Huang, <i>MC68HC11 An introduction, Software and Hardware Interfacing</i> , 2nd Edition, Delmar Thomson Learning, 2001.
Course Coordinator:	Dr. Hakan Gurocak
Course Objectives:	<ol style="list-style-type: none"> 1. Understand microcontroller architecture 2. Gain experience with microcontroller programming and debugging tools 3. Interface electromechanical systems to a microcontroller 4. Understand microcontroller timing subsystems and their functions 5. Develop real-time sensing and control algorithms
Topics Covered:	<ol style="list-style-type: none"> 1. Introduction to microcontroller architecture 2. Number systems and conversions (decimal, binary, hexadecimal) 3. Basics of microcontroller assembly language 4. Monitor commands, memory map, registers and stack 5. Microcontroller programming in C (data types, operators, expressions, flow control, I/O, functions and program structure, pointers and arrays) 6. Port and register blocks, bit masking and I/O access 7. Hardware interfacing (switches, LEDs, transistor as a switch, relays, H-bridges, stepper motors, servo motors, transducer interfacing) 8. Timer systems (input capture, output compare, pulse accumulator) 9. Interrupt events and polling 10. A/D and D/A system 11. Basic control system implementation using a microcontroller (temperature controller, DC motor speed controller)
Lab Experiments and Activities:	Lecture sessions converted into laboratory sessions as needed for demonstrations and hands-on activities.
Course Outcomes:	Students will be able to: C-2. Design a system with an embedded microcontroller following a design process. C-3. Design a system that will meet realistic constraints such as economical, manufacturability, safety, etc.

	<p>C-4. Build a system prototype that meets design specifications.</p> <p>D-1. Contribute to the team work by sharing responsibilities.</p> <p>D-2. Create conceptual designs for the team project.</p> <p>D-3. Work effectively with other on the team through good interpersonal skills.</p> <p>G-2. Deliver project presentations.</p> <p>H-4. Explain the impact of their design solution in an economical context.</p> <p>J-1. Describe the impact of microcontroller technology in a contemporary issue, such as healthcare, environmental, etc.</p> <p>K-2. Interface devices such as switches, relays, DC motors to the microcontroller.</p> <p>K-3. Program a microcontroller to provide solutions for practical problems.</p>	
Required or Elective Course:	Elective	
Contribution to Professional Component:	Engineering Topics	
Relationship of Course to Program:	Meets: Educational Objectives <u>1, 2, 3, 4</u> Program Outcomes <u>C, D, G, H, J, K</u>	
Prepared by:	Dr. Hakan Gurocak	Date: November 1, 2006
Approved by CAC:		