ENGR 172 Mechatronics: Introduction to Microcontrollers, Cuyamaca College

Fall Semester 2009, Section 4596

Saturday 9:00 am – 1:10 pm, Room F301

This course is a continuation of ENGR 170, but with greater focus on the internal details of microcontrollers. We will use a PIC 16F84A microcontroller, a fairly common microcontroller supported by ample literature. We will also be using a new form of BASIC called PICBASIC, which is a more compact and efficient programming language than the PBasic we used in ENGR 170 and 171. There will also be an introduction to the use of assembly language programming. We will also be learning basic analog-to-digital (A/D) conversion, control large AC appliances, and how to make our own printed circuits.

Instructor

Dr. Duncan McGehee
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Office Hours: MW 5 - 6 pm, T 6 - 7 pm, W 2 – 3 pm, Th 12 – 1 pm, or by appointment

Units and Prerequisites

1.5 units. No prerequisites.

Required Equipment

Required: *PIC Microcontroller Project Book, 2nd Edition*. John Iovine, ISBN 0-07-143704-5, McGraw-Hill, 2004.
What's a Microcontroller, A. Lindsay, ISBN 1-928982-02-6, Parallax, Inc., 2004 (ENGR 170 text).
PIC Basic Compiler ($100 from MELabs.com)
ME Labs U2 Programmer with accessories ($120 from MELabs.com) This is a USB-based programmer OR
EPIC Plus Programmer with accessories ($100 from MELabs.com). Parallel port-based programmer
Personal computer with internet access.

Other Required Supplies

USB flash drive. Any size will suffice.

Grading

A: 90 - 100
B: 80 - 89.9999
C: 70 - 79.9999
D: 60 - 69.9999
F: < 60

Lab exercises and projects 100%

ENGR 172 is "project-based", meaning that as you complete projects, the instructor reviews and signs off on them. Each project is worth a certain number of points, and when you complete a lab you submit it for grading. In addition to the signatures, certain projects require schematics and program listings. If you do not include the schematic you will lose a point, and if you do not include the program listing, or if it is poorly commented or badly formatted, you'll lose another point. These points can be recovered if you resubmit the lab with corrections.

Course Objectives (Expected Student Learning Outcomes)

By the end of the class, you will be able to:

1) Read and interpret specifications for an unknown microcontroller
2) Program a microcontroller using a generic programming device
3) Design and build custom microcontroller-based circuits
4) Write and compile programs in a high-level language such as PICBasic using subroutines
5) Write programs and subroutines in Assembly language to:
   a. Provide interrupt and exception handling
   b. Provide direct access to special registers and I/O pins
6) Use microcontrollers to:
   a. Detect inputs from mechanical switches, potentiometers and optical sensors, and use the inputs to control the microcontroller
   b. Control LEDs
   c. Control servo motors
   d. Control high power (AC) circuits using triacs and opto-isolators
   e. Communicate with other integrated circuits such as A/D converters and serial EEPROM
7) Integrate the elements of #1-6 above to create an electromechanical device to achieve a desired goal

Policies

1) This is a lab class, and you are encouraged to help each other on the textbook activities. With the creative projects, although you may discuss your ideas with friends, each project should be unique and original.

Important Dates

4 September: Final day to add classes, or to drop without a 'W'.
25 September: Last day to switch to pass/no pass (In my opinion the best way to take the class).
12 November: Final day to drop classes.

subject to minor changes

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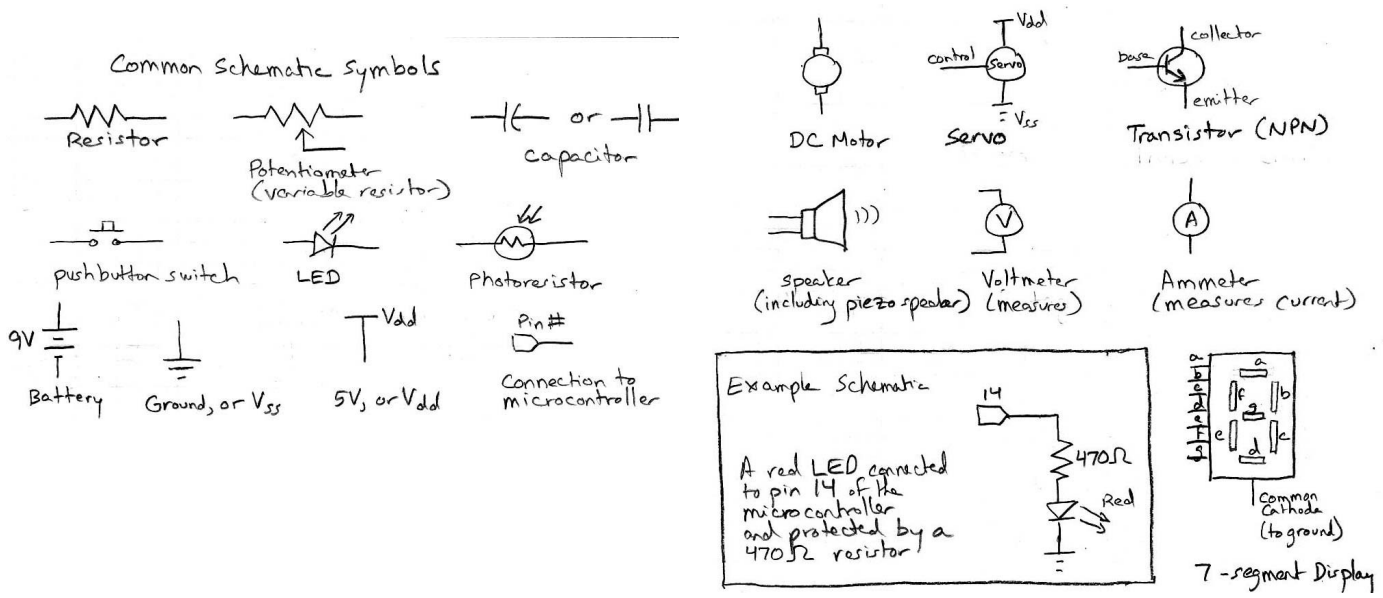
Tentative Schedule

Week	Dates	Topic	Reading
1	29 Aug	Lesson 1 Intro., build power supply, first use of the PIC	Ch 1, pp 1-10, Ch 6
2	5 Sept	Lesson 1 Intro., build power supply, first use of the PIC	Ch 1, pp 1-10, Ch 6
3	12 Sept	Lesson 2 Internal architecture of a µcontroller, projects	Ch 7, Ch 8, Ch 9
4	19 Sept	Lesson 2 Internal architecture of a µcontroller, projects	Ch 7, Ch 8, Ch 9
5	26 Sept	Lesson 3 1st semester projects and techniques, applied to PIC	Ch 13, Ch 14
6	3 Oct	Lesson 3 1st semester projects and techniques, applied to PIC	Ch 13, Ch 14
7	10 Oct	Lesson 4 Introduction to Assembly Language Programming **ALSO THIS IS ROBO ED EXPO weekend at Cuyamaca**	Handouts
8	17 Oct	Lesson 4 Introduction to Assembly Language Programming	Handouts
9	24 Oct	Lesson 5 New sensors, Analog-to-digital conversion, more hardware	Ch 12, Ch 13, Ch 15, handouts
10	31 Oct	Lesson 5 New sensors, Analog-to-digital conversion, more hardware	Ch 12, Ch 13, Ch 15, handouts
11	7 Nov	Lesson 6: Different PIC, making your own printed circuit	Handouts
12	14 Nov	**Veterans' Day Holiday (no class)**	
13	21 Nov	Lesson 6: Different PIC, making your own printed circuit	Handouts
14	28 Nov	**Thanksgiving Weekend (no class)**	
15	5 Dec	Lesson 7: Control of AC machines	Ch 19
16	12 Dec	Lesson 7: Control of AC machines	Ch 19



This course adheres to policies outlined in the Cuyamaca College Catalog. For further information, please see the section of the catalog entitled *Academic Policies*.

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