EE3954 – Microprocessors and Microcontrollers

Spring Semester 2015/2016

Lecture Locations:
Monday, Wednesday, Friday: Academic & Research Center 106 (ARC 106)
Labs: Stocker 306

Instructors: Maarten Uijt de Haag, Ph.D.
Room: 337 Stocker Center
E-mail: uijtdeha@ohio.edu

Required Materials:


PIC 16F87X Data Sheet for 28/40 Pin 8-bit CMOS FLASH Microcontrollers, by Microchip Technology Inc. Literature #DS30292C, (available on my website).

Office Hours: (by email appointment only)

Monday, Tuesday, Wednesday: 11:00 – 11:50 a.m.

(Please make appointment via email at least 1 day in advance)

Lab Notebook:

None Required

Requisites:

(CS 210 or CS 240A or CS 2400) and (EE102 or EE1024)
**Course Format:**

Lecture sessions will meet from 11:50 AM to 12:45 PM on **Monday, Wednesday, and Friday** in Academic & Research Center 106 (ARC 106). The lab sections will meet at the following times:

- **Section 101:** **Tuesday** from 9:40 am to 11:30 am (Stocker 306)
- **Section 102:** **Thursday** from 9:40 am to 11:30 am (Stocker 306)

**Attendance Policy:**

Attendance in lecture sections is strongly recommended but not required. **Attendance is mandatory for laboratory** meetings that have experiments scheduled. Only university excused absences will be permitted for laboratory sessions.

**Grading:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Midterm 1</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm 2</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>10%</td>
</tr>
<tr>
<td>Lab Exercises</td>
<td>30%</td>
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</tbody>
</table>

Your letter grade will be determined from the following chart:

- 94-100 **A**
- 90-93 **A-**
- 87-89 **B+**
- 83-86 **B**
- 80-82 **B-**
- 77-79 **C+**
- 73-76 **C**
- 70-72 **C-**
- 67-69 **D+**
- 63-66 **D**
- 60-62 **D-**
- 0-59 **F**

**Academic Misconduct:**

All work is to be the original work of the individual, or in the case of lab experiments, the two lab group members. Depending on the severity, individuals performing plagiarism, cheating, and/or any other violation of the *Student Code of Conduct* may result in a zero for the assignment, may receive a grade of F for the class, and may be referred to the Ohio University Judiciaries for disciplinary action.
Student Outcomes vs. Course Learning Objectives

A: Ability to Apply Knowledge of Math, Science and Engineering

- Ability to understand the microcontroller architecture and operation.
- Ability to understand the working of the microcontroller data, addressing and control system.
- Ability to understand and predict software and hardware timing functions.
- Ability to understand electrical interfacing parameters and to calculate and predict electrical operating conditions.
- Ability to understand and control the microcontroller’s on-chip peripheral devices.
- Ability to apply basic processor arithmetic in binary, hexadecimal and decimal base number systems.

B: Design and Conduct Experiments, Analyze and Interpret Data

- Ability to define and solve tasks using microcontroller assembly language programming.
- Ability to control on-chip peripherals and measure their performance.
- Ability to design an experimental method to solve for a given task and assess its outcome.
- Ability to decide what data must be collected to confirm that the given task performs within specifications.

G: Ability to communicate effectively

- Ability to write: description of the task, approach taken toward a solution, and conclusions from observed data.
- Ability to collect, present, and explain collected data to confirm tasks are successfully achieved.

K: Ability to use the techniques, skill, and modern engineering tools necessary for engineering practice.

- Ability to use MPLabX Microcontroller development software and hardware.
- Ability to use manufacturer’s data sheets and reference manuals to achieve understanding of operation and limitations of the manufacturer’s device.

Course Content:
See Planned Course Schedule on following page.

Final Exam Schedule:
Final Exam is scheduled for Wednesday, April 27, at 10:10 a.m.
## EE 3954

### Microprocessors and Microcontrollers

**Planned Course Schedule:** May be adjusted during the Semester

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>1</td>
<td>1/11 1/15</td>
<td>Syllabus &amp; Intro microcontrollers Architecture (1)</td>
<td>No Lab</td>
<td>No Class (Video on Architecture)</td>
<td>No Lab</td>
<td>No Class (Video on Oscillators)</td>
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<tr>
<td>2</td>
<td>1/18 1/22</td>
<td>Martin Luther King, Jr. Day</td>
<td>No Lab</td>
<td>CPU &amp; ALU (1)</td>
<td>No Lab</td>
<td>CPU &amp; ALU (2) Instructions</td>
</tr>
<tr>
<td>3</td>
<td>1/25 1/29</td>
<td>Program Memory (1)</td>
<td>No Lab</td>
<td>Program Memory (2)</td>
<td>No Lab</td>
<td>Data Memory (1)</td>
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<tr>
<td>4</td>
<td>2/1 2/5</td>
<td>Flow-charts, Assembler, and Development Tools</td>
<td><strong>Lab #0 Intro/Tutorial</strong></td>
<td>Data Memory (2)</td>
<td><strong>Lab #0 Intro/Tutorial</strong></td>
<td>Timing loops (1)</td>
</tr>
<tr>
<td>5</td>
<td>2/8 2/12</td>
<td>Timing loops (2): Algebraic exp</td>
<td><strong>Lab #1 Ind.addr/mem</strong></td>
<td>Timing loops (3) Lab report req.</td>
<td><strong>Lab #1 Ind.addr/mem</strong></td>
<td>Exam #1 review topics</td>
</tr>
<tr>
<td>6</td>
<td>2/15 2/19</td>
<td><strong>Exam #1</strong></td>
<td>No Lab</td>
<td>I/O ports (1)</td>
<td>No Lab</td>
<td>Lab 2 preparation I/O Ports (2)</td>
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<tr>
<td>7</td>
<td>2/22 2/26</td>
<td>I/O ports (output configurations)</td>
<td><strong>Lab #2 I/O port/7seg</strong></td>
<td>Exam 1 review &amp; solutions</td>
<td><strong>Lab #2 I/O port/7seg</strong></td>
<td>I/O Ports (inputs,scmitt)</td>
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<tr>
<td>8</td>
<td>3/7 3/11</td>
<td>Interrupts (1)</td>
<td>No Lab</td>
<td>Interrupts (2)</td>
<td>Interrupts (3)</td>
<td>Timer0 (1) Explain Lab #3</td>
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<tr>
<td>9</td>
<td>3/14 3/18</td>
<td>Timer1 (1)</td>
<td><strong>Lab #3 Timer1/Interrupts</strong></td>
<td>Timer1 (2)</td>
<td><strong>Lab #3 Timer1/Interrupts</strong></td>
<td>ADC (1)</td>
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<tr>
<td>10</td>
<td>3/21 3/25</td>
<td>ADC (2)</td>
<td>No Lab</td>
<td>ADC (3) Explain Lab #4</td>
<td>No Lab</td>
<td>Exam #2 review topics</td>
</tr>
<tr>
<td>11</td>
<td>3/28 4/1</td>
<td><strong>Exam #2</strong></td>
<td><strong>Lab #4 A/D convert</strong></td>
<td>Comm (1) UART</td>
<td><strong>Lab #4 A/D convert</strong></td>
<td>Comm (2) UART</td>
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<tr>
<td>12</td>
<td>4/4 4/8</td>
<td>Comm (3) Explain Lab #5</td>
<td><strong>Lab #5 USART/com</strong></td>
<td>C Programming</td>
<td><strong>Lab #5 USART/com</strong></td>
<td>C Programming</td>
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<td>I2C/SPI (1)</td>
<td>Lab #6 C-prog</td>
<td>I2C/SPI (2)</td>
<td>Lab #6 C-prog</td>
<td>I2C/SPI (3)</td>
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<tr>
<td>13</td>
<td>4/11 4/15</td>
<td>I2C/SPI (1)</td>
<td>Lab #6 C-prog</td>
<td>I2C/SPI (2)</td>
<td>Lab #6 C-prog</td>
<td>I2C/SPI (3)</td>
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<tr>
<td>14</td>
<td>4/18 4/22</td>
<td>Reset &amp; Watchdog timer</td>
<td>(Lab #7 SPI)</td>
<td>Sleep</td>
<td>(Lab #7 SPI)</td>
<td>Final Exam Review</td>
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