Course Description: (Corequisite: EE3/486) Motorola MC9S12 microcontroller (MC6800 based) assembly programming, debugging, and peripheral interfacing.

Course Learning Outcomes/Linkage to ECE Program Outcomes:
Upon the successful completion of this lab, students will be able to:

- Appreciate the value of systematic design, proper documentation and engineering professionalism. (ECE g)
- Write, assemble, load and execute simple programs in assembly language. (ECE a,c)
- Explain the relationship between assembly instructions and machine code. (ECE a)
- Demonstrate the ability to trace, breakpoint, and debug assembly code on a microcontroller or microprocessor. (ECE d,k)
- Interface basic peripheral functions between assembly code applications and switches, BCD indicators, and PWM drivers. (ECE b,c,d,e)
- Utilize analog to digital converters to interface microcontroller software to various sensors. (ECE b,c,d,e)
- Interface a microcontroller to external serial devices via RS-232 (SCI) and SPI protocols. (ECE b,c,d,e)

Instructor: Dr. Nizar Al-Holou, Professor, E 330, 993-3365, alholoun@udmercy.edu

Office Hours: As posted, others by appointment

Teaching assistance: Mr. Utayba Mohammad, mohammua@students.udmercy.edu
Mr. Cheng-Lung Lee, lunglech@students.udmercy.edu

Class Meetings: 2:00pm-5:00 p.m. Monday, E360

Required Text: Reference material for the HCS12 processor provided courtesy of Freescale Semiconductor. Material is to be returned in good condition at the end of the course.

Prerequisites by Topic: Digital Logic, Introductory Electric Circuits or Physics II.

Requirements:

Web Resources: This course has a web site at: http://knowledge.udmercy.edu
If you do not already have an account on this server, please go to http://knowledge.udmercy.edu and create an account. Once you have your account, you must go to the course web site and click on the enroll button to be added to the roster. Important announcements and other resources will be available on the web site. It should be consulted frequently, since updates are made regularly. You must be enrolled on the course web site.

Attendance: The microprocessor laboratory provides the student an opportunity to apply the lecture concepts in practical engineering situations. Attendance is strictly required. Each lab session in which greater than one of three hours is missed will result in a 5% reduction in the final lab grade. Only in extreme circumstances, evaluated on a case-by-case basis, will make-up sessions or opportunities be provided. E-mail notification of absenteeism in advance, where possible, will be weighted when considering make-up sessions.

Timeliness: Students are expected to be in lab, and ready to begin, promptly at the posted starting time. Students that are late to lab will individually receive a 1%-per-minute reduction in grade for the assignment of the day. Tardiness in excess of 60 minutes will result in an absenteeism penalty, as prescribed above. The faculty respects the value of each student’s time, and therefore offers 1%-per-minute late to lab, up to 5%, for faculty tardiness to lab. Assignments (including functional demonstrations) handed in after the end of the normal lab period will be penalized by 15%, up to
EE 3/487 – Introduction to Microprocessors - Lab

one week after the due date. Assignments handed in more than one week late will receive no credit. Pre-arranged exceptions may be considered.

Teamwork: Lab teams will be established in groups of two or three students. The lab teams will be established in the first one or two lab sessions, and may only change with permission from the instructor. Each student is expected to participate to the best of their ability and interact in a professional manor. Lab assignments will be given a group grade; however, certain assignments will be administered on an individual basis to ensure each student masters all the lab concepts.

Pre-lab reading and assignments: Students are expected to read the lab assignment sheet prior to attending lab. Quizzes may contain questions from the current week’s pre-lab, all previous pre-labs, and material covered by EE386 lecture or lab lecture.

Exams: Two lab-practical exams will take place during the course. The exams ensure that each student is participating fully, independent of team performance. Make-up exams are not generally given; however, should a legitimate emergency arise, a make-up may be arranged.

Professionalism: Engineering is a profession, and as such, lab work is to be completed in a professional manor. Communications is an important element of engineering. All lab work will be fully documented and professionally prepared. Clear examples of documentation expectations will be provided in the initial labs. The two labs will require formal lab reports that will be graded as heavily on professionalism as technical completeness.

Graduate Students: Graduate students enrolled in EE487 are held to a higher standard, subject to different class curves, and are expected to complete all regular class assignments in addition to a design project assigned concurrently.

Grade: Each student will accumulate two grades: a group grade and an individual grade

Group Grade:
- Pre-labs & Participation 20%
- Labs 30%

Individual Grade:
- Mid-term Exam 20%
- Final Exam 30%

The grading scale for the course is as follows:

<table>
<thead>
<tr>
<th>% Average</th>
<th>93-100%</th>
<th>89-92%</th>
<th>85-88%</th>
<th>80-84%</th>
<th>75-79%</th>
<th>70-74%</th>
<th>65-69%</th>
<th>60-64%</th>
<th>55-59%</th>
<th>50-54%</th>
<th>0-49%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Grade</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
<td>C+</td>
<td>C</td>
<td>C-</td>
<td>D+</td>
<td>D</td>
<td>F</td>
</tr>
</tbody>
</table>

IMPORTANT DATES
- September 13: Last Day to Add a Class
- September 30: Last Day to Drop a Course without a Withdrawal “W”
- November 21: Last Day to Withdraw from Class
- November 24-27: Thanksgiving Recess (University Closed)
- December 12-17: Final Exam Week
- December 17: Official End of Term I/Fall 2005-2006

Revised: 09/05/05

Page 2
EE 3/487 – Introduction to Microprocessors - Lab

TENTATIVE COURSE OUTLINE

<table>
<thead>
<tr>
<th>DATES</th>
<th>TOPICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/12</td>
<td>Introduction to UDM-EVB, DeBug12, .s19 files and machine code</td>
</tr>
<tr>
<td>9/19</td>
<td>Assembly and Debugging</td>
</tr>
<tr>
<td>9/26</td>
<td>Addressing Modes</td>
</tr>
<tr>
<td>10/03</td>
<td>Branches and Loops</td>
</tr>
<tr>
<td>10/10</td>
<td>Subroutines</td>
</tr>
<tr>
<td>10/17</td>
<td>Mid-term Lab Practical Exam – Graduate design project assigned</td>
</tr>
<tr>
<td>10/24</td>
<td>Port I/O – Switch inputs and LED / BCD outputs</td>
</tr>
<tr>
<td>10/31</td>
<td>Analog to Digital Conversion</td>
</tr>
<tr>
<td>11/07</td>
<td>Interrupts/Serial Communications</td>
</tr>
<tr>
<td>11/14</td>
<td>Timers and PWM control – Week 1</td>
</tr>
<tr>
<td>11/21</td>
<td>Timers and PWM control – Week 2</td>
</tr>
<tr>
<td>11/28</td>
<td>Timer and PWM Project Presentations – Major Report Due</td>
</tr>
<tr>
<td>12/05</td>
<td>Final Lab Practical Exam</td>
</tr>
</tbody>
</table>

Acknowledgement: We would like to acknowledge the support that we received from Motorola & Freescale to build the UDM-Board & provide brand new boards.