Course Number: EE 390
Course Title: Digital System Engineering (Required Course)

Course Description:

Prerequisites:
EE-200 and ICS 103

Textbook:

Other useful references and material:

Course objectives:
After successfully completing the course, the students will be able to
- Develop an understanding of basic computer organization
- Provide comprehensive understanding of software and hardware models of 8086 and 8088 microprocessors and related Assembly language programming
- Carry out (theoretically and experimentally) basic Memory Mapping, Input-output interfacing and Microcontroller programming.
- Train engineers how to practice and apply their electrical engineering knowledge in a professional, ethical and safe manner.

Topics Covered:
- 8086/8088 Microprocessor internal architecture
- Software model and memory organization.
- Addressing modes
- Program Debugging tools (DEBUG and Turbo-DEBUG)
- Assembly Language instruction set of 8086/8088
- Assemblers (TASM or MASM)
- Assembly Language Directives
- 8086 and 8088 hardware architecture
- Memory Interface circuits
- Memory Devices
- Input/output interface circuits
- Introduction to Interrupt interface and Microcontrollers basics

Class/Laboratory Schedule:
3 lectures per week (50 minutes each) and 3 hours lab per week.

Contribution of course to Meeting the professional component:
The students will learn software and hardware models of basic 80x86 microprocessors and how to program them using assembly language. The course will emphasize on the use of professional emulators and software’s, such as, debugging tools (DEBUG or TD) and assemblers (TASM or MASM). Laboratory classes are designed to promote and strengthen the knowledge acquired in this course. The course project is intended to test the innovativeness and competency in programming and interfacing techniques. Basic Microcontroller programming are also introduced in this course.

Course Outcomes:
- Ability to use software development tools to assemble, test and debug the programs by using breakpoints, single-stepping, monitoring the changes in register/memory contents, on a hardware platform or on an emulator.
- Ability to apply assembly directives to initialize memory for global variables and use assembly language to implement flow control (sequential, conditional and iterative)
- Ability to write assembly language programs for 8088/8086 microprocessors to read and write the registers in an I/O adapter that control the communication with I/O devices. Write basic programs for 8051 microcontroller.
- Understand how the 8086 and 8088 microprocessors identify different sources of interrupts and exceptions, and invokes the corresponding handler to deal with the interrupt and exception.

Prepared by Dr. Sheikh Sharif Iqbal, February, 2012.
### Topics

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Laboratory</th>
<th>Book Assignments</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 28 – Feb 1</td>
<td>No Lab</td>
<td>Ch 1 Problems: 5 - 15, 28, 32, 33, 37, 40, 42, 43, 47, 48, 2.3.2.4, 2.9, 2.10 - 2.19, 2.23 - 2.27, 2.34, 2.37, 2.41, 2.46, 2.53 - 2.60, 2.64 - 2.66</td>
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<tr>
<td>2</td>
<td>February 4–8</td>
<td>Experiment 0: PC Hardware...</td>
<td>Ch 2: 1. Introduction to Debug &amp; Turbo, 1.5.3 – 1.11</td>
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<td>3</td>
<td>February 11–15</td>
<td>Help session on TD, Emulator</td>
<td>Ch 3: Ch 7 Problems: 7.3 – 7.6, 7.10 – 7.16, 9.5.5 - 5.5</td>
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<tr>
<td>4</td>
<td>February 18–22</td>
<td>Help session on TD, Emulator</td>
<td>Ch 5: Ch 6 Problems: 6.5 – 6.5, 6.8, 6.15, 6.21, 6.22</td>
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<tr>
<td>6</td>
<td>March 3 - 7</td>
<td>3. Arithmetic instructions...</td>
<td>Ch 5: Ch 6 Problems: 6 – 6.5, 6.8, 6.15, 6.21, 6.22</td>
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<td>7</td>
<td>March 10 –14</td>
<td>Problem session</td>
<td>Ch 6: Ch 6 Problems: 6.25, 6.29, 6.31, 6.39, 6.43, 6.45, 6.48</td>
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<td>8</td>
<td>March 17 – 21</td>
<td>4. Shift and rotate .....</td>
<td>Ch 8: Ch 8 Problems: 8.7, 8.11, 8.16, 8.19, 8.28, 8.32, 8.33, 8.37, 8.40, 8.42, 8.101, 8.103, 8.105</td>
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**Mid Semester Break : March 24 - 28**

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Laboratory</th>
<th>Book Assignments</th>
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<tbody>
<tr>
<td>9</td>
<td>March 31 – April 4</td>
<td>5. Using BIOS Services (Part I)</td>
<td>Ch 6: Ch 7 Problems: 10.5, 10.5, 10.10, 10.10, 10.12, 10.14, 10.17, 10.23, 10.25, 10.26</td>
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<tr>
<td>10</td>
<td>April 7 - 11</td>
<td>6. Using BIOS Services (Part II)</td>
<td>Ch 6: Ch 7 Problems: 10.31 – 10.35, 10.37, 8.85, 8.87, 8.89, 8.91, 8.93, 8.96, 8.99, 8.100, 8.101, 8.103, 8.105</td>
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<tr>
<td>11</td>
<td>April 14 – 18</td>
<td>7. Introduction to Flight86...</td>
<td>Ch 6: Ch 7 Problems: 8.85, 8.87, 8.89, 8.91, 8.93, 8.96, 8.99, 8.100, 8.101, 8.103, 8.105</td>
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<tr>
<td>13</td>
<td>April 28 – May 2 (Exam 2=April 29)</td>
<td>9. Flight86 - II: Motor Control</td>
<td>Ch 7: Ch 8 Problems: 5 - 15, 28, 32, 33, 37, 40, 42, 43, 47, 48, 2.3.2.4, 2.9, 2.10 - 2.19, 2.23 - 2.27, 2.34, 2.37, 2.41, 2.46, 2.53 - 2.60, 2.64 - 2.66</td>
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<td>14</td>
<td>May 5 – May 7</td>
<td>10. Introduction to the 8051 Microcontroller -- Important</td>
<td>Ch 8: Ch 8 Problems: 8.7, 8.11, 8.16, 8.19, 8.28, 8.32, 8.33, 8.37, 8.40, 8.42, 8.101, 8.103, 8.105</td>
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<tr>
<td>15</td>
<td>May 12 – May 16</td>
<td>LAB FINAL</td>
<td>Ch 9: Ch 9 Problems: 9.2, 9.6, 8.8, 9.11, 9.14, 9.16, 9.17, 9.21, 9.28, 9.29, 8.85, 8.87, 8.89, 8.91, 8.93, 8.96, 8.99, 8.100, 8.101, 8.103, 8.105</td>
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**Textbook:** ‘The 8088 and 8086 Microprocessors’ by Triebel and Singh latest edition.

**Grading:** Quiz+Project+HW (13+5+2)% ; Major-1 15% ; Major-2 15% ; Final-exam 30% ; Lab 20%

**Major Exams:**
- **Exam 1:** Saturday: 17th March ; 8:00 –9:00 PM ; Room: 59 - 1001
- **Exam 2:** Sunday: 29th April ; 7:30 – 9:00 PM ; Room: 59 - 1001

**Absences:** University rules: -- 4 unexcused absences ➔ Warning ; -- 6 unexcused absences ➔ DN.

**Reference Books:** ‘Introduction to 80x86 assembly language and computer architectur’ by Detmer, Richard C