ECE 441 - Microcomputers

2012 Catalog Data:
ECE 441: Microcomputers. Credit 4
Prerequisite(s): [(CS 350) OR (ECE 242)] AND [(CS 470) OR (ECE 218)]
(3-3-4) (C)(P)

Enrollment:
Required course for CPE majors; elective course for EE majors.

Textbook:

Coordinator:
J. Saniie, Filmer Professor of ECE

Course goals:
After completing this course, the student should be able to do the following:
1. Describe the MC68000 microprocessor’s architecture, pin functions, instructions and addressing.
2. Implement exception processing software routines and function controls.
3. Design memory hardware and bus timing of address, data and control signals.
4. Design input/output interfaces to the microprocessor.
5. Design a system utilizing programmable input/output devices and synchronous bus control signals.
6. Design a system utilizing an asynchronous programmable input/output device and trap handler.
7. Perform hardware design for DTACK logic, reset and interrupts.
8. Design, implement, and test a monitor software project incorporating engineering standards and realistic constraints.
9. Complete an engineering design incorporating engineering standards and realistic constraints.
10. Prepare an informative and organized design project report.

Prerequisites by topic:
1. Digital logic
2. Basic electronics
3. Ability to work with assembler and simulator software

Lecture schedule:
Two 75-minute sessions per week

Laboratory schedule:
One 150-minute session per week

Topics:
1. Importance of the microcomputer and recent developments in microprocessor design (1 week)
2. MC68000 architecture, pin functions, instructions and addressing (1 week)
3. Interrupt handling, exception processing, and function controls (2 weeks)
4. Timing of address, data and control signals (1 week)
5. Memory design (1 week)
6. Input/output design (1 week)
7. Synchronous bus control signals (1 week)
8. Design with programmable input/output device (2 weeks)
9. Design with asynchronous programmable input/output device (2 weeks)
10. Hardware design for reset, bus timeout logic and interrupts (2 weeks)
11. Tests (1 week)

Computer usage:
Students use Sanper Educational Computer, MC68000 assembler and simulator software to implement and test their projects.
Laboratory topics:
1. Introduction to Sanper-1 Microcomputer Architecture and TUTOR Resident Monitor Program
2. Tutor command utilization and program development
3. Interrupts and exception processing
4. Code conversion, bit manipulation, and software development
5. Design memory hardware and bus cycle timing
6. Design input/output hardware and interrupt logic
7. Design with the programmable parallel input/output device
8. Design with the programmable asynchronous serial input/output device
9. Design and implement a monitor software

Relationship of ECE 441 Course Goals to Student Outcomes:

<table>
<thead>
<tr>
<th>Student Outcomes:</th>
<th>Course Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Apply knowledge of math, engineering, science</td>
<td>1,2,3,4,5,6,7,8,9</td>
</tr>
<tr>
<td>b. Design and conduct experiments / Analyze and Interpret Data</td>
<td></td>
</tr>
<tr>
<td>c. Design system, component, or process to meet needs</td>
<td>2, 3, 4, 5, 6, 7, 8, 9</td>
</tr>
<tr>
<td>d. Function on multi-disciplinary teams</td>
<td></td>
</tr>
<tr>
<td>e. Identify, formulate, and solve engineering problems</td>
<td>1,2,3,4,5,6,7,8,9</td>
</tr>
<tr>
<td>f. Understand professional and ethical responsibility</td>
<td></td>
</tr>
<tr>
<td>g. Communicate effectively</td>
<td>10</td>
</tr>
<tr>
<td>h. Broad education</td>
<td></td>
</tr>
<tr>
<td>i. Recognize need for life-long learning</td>
<td></td>
</tr>
<tr>
<td>j. Knowledge of contemporary issues</td>
<td></td>
</tr>
<tr>
<td>k. Use techniques, skills, and tools in engineering practice</td>
<td>9</td>
</tr>
</tbody>
</table>

Prepared by: J. Saniie  Date: October 20, 2013