ECE 3610 – Microprocessor Systems

Course Objectives

This course introduces the student to fundamentals of microprocessors and microcomputers. The topics include: data flow, machine programming, architectures and instructions sets, stacks, subroutines, I/O and interrupts, interfacing fundamentals, and designing with microprocessors.

Course Content

The following topics will be covered:

- Review of number systems, logical operations, and digital circuits
- Verilog design of a tiny operation set computer
- A basic 8-bit microprocessor
- Macro/micro-instruction programmability and animation
- Condition code register
- Assembly language programming
- Addressing modes
- Program writing methodology
- Examples of assembly language program structure and flow
- Computer decisions and branch instructions
- Transfer, arithmetic, and logic instruction
- The stack and subroutines
- Assemblers
- Integrated development environment
- Basic microprocessor interfacing
- Address decoding in memory mapped systems
- Memory mapped I/O and interrupts
- Multiple sources of IRQs and interrupt priority
- Peripheral interface adapter
- Memory accessing techniques and direct memory access
- Design examples.

Textbook

*Microprocessing Systems* - Ken Ferens (distributed in class)

Other References

- *68000 Family Assembly Language*, by Alan Clements
- *Using Microprocessors and Microcomputers: The Motorola Family*, by Greenfield and Wray
- *The 68HC11 Microcontroller*, by J. D. Greenfield
- *The Motorola MC68000*, by Jean Bacon
- *Microprocessor Systems Design*, by A. Clements
- *Microcontroller Technology, the 68HC11*, by Peter Spasov

Requirements/Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic Regulations*.
Accreditation Details

**Accreditation Units**
- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 70%
- Engineering Design: 30%

**Attributes**
A1: A knowledge base for engineering
A2: Problem analysis
A3: Investigation
A4: Design
A5: Use of engineering tools
A6: Individual and team work
A7: Communication skills
A8: Professionalism
A9: Impact of engineering on society/environment
A10: Ethics and equity
A11: Economics and project management
A12: Life-long learning

**Competency Levels**
1 - Knowledge (Able to recall information)
2 - Comprehension (Ability rephrase information)
3 - Application (Ability to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships.)
5 - Synthesis (Able to combine separate elements into a whole)
6 - Evaluation (Able to judge the worth of something)

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*Regulations* dealing with incomplete term work, deferred examinations, attendance and withdrawal.

- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

**Learning Outcomes**
1. Ability to design a simple microprocessing system.
2. Develop assembly language programs.
3. Identify, define, and describe the components of basic microprocessor architecture.
4. Apply interrupts and polling for I/O.
5. Create micro-operations for new macro-instructions.

**Expected Competency Levels**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>A1</th>
<th>A2</th>
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**Evaluation**
The final course grade is determined by the student’s performance on a design project, in laboratories, and on examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade. Students must pass the final exam to be eligible to receive a passing grade.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Method of Feedback</th>
<th>Learning Outcomes Evaluated</th>
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<tbody>
<tr>
<td>Assignments/Project</td>
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<td>F, S</td>
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<tr>
<td>Laboratories</td>
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<td>F, S</td>
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<td>Term Tests</td>
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<td>Final Examination</td>
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*Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)*

**Academic Integrity**

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Updated: 03 January 2015