ELE 356: COMPUTER ENGINEERING II (required)

Credit: 4 hours.

Catalog Description: Analysis of microprocessors with emphasis on architecture, bus cycle, internal registers, addressing modes, and instruction sets. Memory and I/O interface techniques. Lecture, discussion three periods per week; laboratory, problem session two periods per week.

Prerequisites: ELE 250.

Textbooks(s) and/or Other Required Materials: Microcomputer Engineering by Gene H. Miller, Prentice-Hall.

Topics Covered:

* Competency test
  laboratory environment/development tools
  von Neumann architecture
  Overview of Motorola's MC68xx 8-bit microprocessor family
* hardware model
  microcomputer concepts/hardware organization
* software model - addressable registers
* addressing modes
* Instruction formats
* Assembler instruction syntax
* Instruction categories, syntax and semantics
  data transfer
  arithmetic
  multiply/divide
  logical
  string/bit manipulation
  shift/rotate
  interrupts
  condition code register
  branch/control
* Interrupts
* Input/output
* (Software engineering)

Class/Laboratory Schedule:

Lecture: 3 hours/week
Lab: 1 hour/week

Course Objectives and Relationship to Program Outcomes:

1. The acquisition of the fundamental concepts of the von-Neuman architecture. Outcomes: A.
2. The acquisition of a hardware & software architectural understanding of the 8-bit M68HC11 microcomputer. Outcomes: A, B, C, E, I, J.

3. The ability to analyze, design, implement and debug assembly level programs. Outcomes: A, B, C, E, G, K.

This course is structured to provide undergraduates with an architectural understanding of the 8-bit Motorola MC68HC11 microcomputer. The successful participants will have an in-depth ability to analyze, design and implement assembly level programs directed toward a wide variety of problem areas. Fundamental concepts of von-Neumann architectures will be revealed; the relationship of assembly level code to machine level code and timing will examined. (Time permitting structured software development methodology will be introduced with emphasis placed upon the structured analysis phase.)

Laboratory experiments introduce the students to a simulator, assembler/editor and finally an emulator that works with the 68HC11 microcontroller. The first assignments introduce the students to the registers of the 68HC11 using the simulator. Several instructions are entered into the simulator using a one-pass assembler, and the effect each instruction has on the registers is observed and recorded. After eight weeks, the students are using a two-pass assembler to generate the machine code. The program is tested in the simulator for proper operation. The remaining four weeks are used to introduce the emulator to test code written for a class project that involves interfacing to a LCD display, A/D converter and switches.

**Coverage (and level) of ABET Outcomes:** A (3), B (3), C (3), E (3), G (2), I (2), J (1) and K (3).

**Contribution of Course to meeting the Professional Component:**
Engineering Topics: 100%

**Date:** June 2004.