Usage 1997-99 Catalog Data: ECE4273 - Digital Design Laboratory. Prerequisite: ECE3223, ECE3872. Design of digital systems with integrated circuits and MSI/LSI and microprocessor interfacing. Laboratory (F, Sp).

Prerequisite: ECE3223-Microprocessor System Design, ECE3872-Electrical Engineering Laboratory III.


Prerequisites by Topic:
1. Microcomputer assembly language programming and peripheral interfacing.
2. Design of combinational and sequential logic circuits.
3. Memory system design and knowledge of various memory types.

Topics:
1. Digital systems design considerations: design practice, use of OrCad, construction techniques, and hardware/software tradeoffs. (2 Classes)
2. MSI/LSI familiarization, device characteristics and usage. (1Class)
3. MC68HC11 system familiarization, configuration and operating modes, processor architecture, timing, instruction set, parallel I/O ports, interrupts, time and pulse accumulator, A/D converter, serial communications (SCI and SPI), interfacing and expansion techniques. (12 classes)
4. MC68HC11EVBU based design project: proposal, hardware/software design, construction, testing, debugging, OrCad design capture, project report (two student teams).

Schedule:
Lecture and laboratory experiments are offered for the first 10 weeks. Design project with individual team meetings with the professor for the remainder of semester. Demonstrations occur during the last two weeks of the semester. Final project reports are due at the end of the final week of class.

Computer:
1. Six lab experiments require writing, debugging and running 68HC11 assembly language programs for EEPROM, I/O port usage, A/D conversion, serial communication, pulse counting and signal period measurement, interrupt and polled I/O methods, memory expansion (OrCad schematic capture) and digital logic analyzer usage.
2. Design project requires continuous usage of a computer.

Design Projects:
A 68HC11EVBU based project proposed by two-student teams, approved with changes by the professor. Students are responsible for all aspects of the project, including hardware implementation and software design. Projects typically contain 500-2500 lines of assembly code and 10-20 MSI/LSI devices. Proposal, OrCad schematic, block diagram, logbook, software listing, oral presentation, and final report are all required. (12 weeks).

Laboratory Projects:
1. Lab experiment to (1) read and write I/O ports, and (2) erase and program EEPROM.
2. Lab experiment to (1) generate square wave under interrupt control, and (2) use I/O strobe control and (3) control a DC motor.
3. Lab experiment to (1) measure the period of a an externally generated square wave, and write data to an LCD display using the Serial Communications Interface.
4. Lab experiment to measure temperature using the A/D converter and display the degree F on an LCD display.
5. Lab experiment to read data from a hex keypad and display it on an LCD display.
7. Lab experiment to (1) utilize the digital logic analyzer for capturing timing and state data, and (2) add 4K of RAM memory, demonstrate memory operation and capture timing using the digital logic analyzer.

8. **Equipment and instrumentation used:** 68HC11EUVB, oscilloscope, digital logic analyzer, UDLP board, digital multimeter, power supplies, and PC.

**Assessment Methods Used:**
Lab experiments and reports, project proposal, demonstration, and final report.

**Contribution to Professional Component:**
Teamwork, task planning and allocation, time management, communication, application of knowledge and skills.

**Program Objectives, Related Strategy, and Actions:**
Design and implementation of microprocessor/microcontroller based digital systems, top-down design, hardware/software tradeoffs, effective documentation.

**ABET 2000 Criterion 3 Contents:** a, b, c, d, e, f, g, k

**Prepared by:** Monte P. Tull  **Date:** June 2, 1999