Teaching Assistant(s)

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Catalog Description

- Hardware and software for real-time microprocessor based digital systems. Basic concepts and operations of on-chip components related to digital system functionality. Architectures, instructions sets, and interfacing with peripherals through serial or parallel ports. Introduction to 16- and 32-bit machines with in-depth treatment of 8-bit machines. Emphasis on C language cross-compilers. Laboratory exercises are included to demonstrate hardware and software development techniques practiced in industry.

- Weekly laboratory exercises in programming microprocessors and a final exercise design enhancement are required.
Course Goal

- **Goal**
  - To provide fourth year ECSE students with a hands-on laboratory experience with more advanced features of state-of-the-art microprocessor systems

- **Means**
  - Exploratory laboratory exercises for the microcontroller (fixed procedures plus small student enhancements)
  - An extended design augmentation is part of the final exercise
Course Project Objective

Objective

- A culminating experience applying much mathematics, science, and engineering from previous terms
- Provide an environment where students develop skills necessary to complete the projects without structured instruction

Required Component

- Analysis and Reports documenting exercises & enhancements
- Must be completed by due dates
Course Prerequisites

- Prerequisites by topic
  - Fundamentals of logic design
  - Fundamentals of circuit design
  - Computer programming
  - Computer instruction sets
  - Microcontroller operations
  - Peripheral operations and control of external hardware
References

Books

- Many references are available, but none are required for the class

Online (www.ecse.rpi.edu/Courses/CStudio)

- Most important reference (free download)
  C8051F120 Technical Summary (Rev. 1.4)
MPS is a WebCT Course

- http://rpilms.rpi.edu/
  - Log in
  - Pick ‘ECSE_4790_XXXX - Microprocessor Systems […]’

- (alternative access to most information at http://www.rpi.edu/dept/ecse/mps)

- Class handouts are here plus several reference manuals
## Course Handouts (available on the web)

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Microcontrollers Available

- C8051F120 — 8 bit machine introduced about 2002
- C8051F040 — 8 bit machine introduced about 2000
- MC6811 — 8 bit machine introduced about 1985
- MC6812 — 16 bit machine introduced late 1997
- MC68332 — 32 bit machine introduced about 1990
Software Available

- Cross-assembler — SDCC & Motorola
- C language cross-compiler — SDCC & Introl
- Microprocessor simulator — Motorola
Typical Topics

- Introduction to the C8051F120 microcontroller
  (information available on the MC6811, MC6812 & MC68332 microcontrollers if desired)
- Software development techniques
- Hardware development techniques
- ANSI Terminal features and simple graphics
- Timers & Interrupt programming
- Synchronous & Asynchronous serial communication
- Interfacing memory to the microprocessor bus
- Analog conversion
- Controller Area Network control
Grade Computation

- Grades are assigned based on both team and individual effort
  - Teams of 2  (due dates subject change, check WebCT calendar)
    - 67% Six C8051 exercises (NOT uniformly weighted)
    - 33% Post-project and general course clean up, final project, mini-quizzes, TA evaluation of student lab preparation, performance & participation
What This Means to You

- You get a chance to learn what you need to know to select and apply microcontrollers to applications of your own choosing

- Specific tools you will be using
  - IDE (Integrated Development Environment)
  - C cross-compilers
  - Debuggers
  - Simulators
  - Logic Analyzers
Next Steps

- Reprise the C8051F020 knowledge
  - Do things that you formerly did in Embedded Control
    - Host input/output
    - Interrupts
    - Hardware interfacing
    - etc.

- Follow up action items required of you
  - Make a list of things you need to know about a new microcontroller to be able to understand their functionality and use all the built-in peripherals efficiently & effectively.
Class Requirements

- Writing Center
  - MPS requires written reports for each lab exercise. You are expected to write well-organized reports and will be graded on style as well as content.
  - Use the Writing Center resources to improve your reports
  - All software MUST be well documented in the program listing
Lab Policies

- Lab experiment work (other than project) must be done in teams of only two students
- Attendance will be taken and will count toward your performance grade
  - Unfair to partner when you don’t show up
  - Students with missing partners may team up for experiments
- Academic Integrity: collaboration is encouraged but outright copying of other’s work is unacceptable
- To get the highest grade on a lab exercise, something unique beyond the required tasks must be accomplished and demonstrated as an enhancement to each exercise
- [Final design augmentation may be done in teams of 4 students, if the group desires to tackle a more ambitious effort]
Lab Policies (cont.)

- Lab reports are due by the posted due date. A penalty of 5 points per day late will be assessed.
- New labs build on the results of previous labs. Once a program works for a given exercise, save it and archive it. Use a copy to begin a new exercise. When things stop working you will be able to go back to a known good program and determine if the problem is in the hardware or software.
- Creating a new project file (.wsp) for each program is highly recommended. This keeps track of all .c and .h files used in a build.
- Make sure you explain and demonstrate any enhancements to the TA during check-off.
Important Dates

- Since there have been several semesters with the new format, the experiment schedule will be fairly rigid.
- There will be a schedule posted on the web for when exercises should be in progress and when reports are due.
- All Reports due Mon., Dec. 10 in my office (JEC-6028) at 4:00 PM

Note: dates may be subject to change; check the course WebCT calendar for the latest information.
The End

(Let’s have some fun!)
Grade Computation

- Grades are assigned based on both team and individual effort
  - Teams of 2  (dates subject change, check WebCT calendar)
    ✦ 67% 6(?) C8051 exercises
  - Teams of 2 or 4
    ✦ 18% Student selected course project
      - 4%  Final demonstration
      - 14%  Final project report
        Due Monday, Dec. 10, at 4:00 PM
    ✦ 15% Post-project and general course clean up, mini-quiz, TA evaluation of student lab performance & participation
Important Dates

- Since this is the third semester with the new format, the experiment schedule will be fairly rigid.
- There will be a schedule posted on the web for when exercises should be in progress and when reports are due.
- Course Project Demonstrations by Dec. 6 (sec. 1)
- Final Project Reports due Mon, Dec. 10 in my office or JEC-6048 at 4:00 PM

Note: dates are subject to change; check the course WebCT calendar for the latest information.
Special Projects - 2003

- Part of a MDL (Multidisciplinary Design Lab) Project
- Automobile Enhancements & Others
  - Using eye tracking & computer vision
  - Various Sponsors
  - Project to continue as Independent Senior Design Project through next semester
- More details will follow in later weeks