EEL4746 - Microcomputers I
Three Credits, One hour fifteen minutes, Engineering Topic.

Instructor: Dr. Atoussa Tehrani.


Specific Course Information:

Specific Goals for the Course
a. Specific outcomes of instruction
Upon successful completion of this course, the student will:
1. Extend student knowledge towards the understanding of software, hardware, and compatibility issues of high-performance ARM Cortex-M microprocessors.
2. Understand and apply the key aspects of ARM mbed LPC1768.
3. Learn about interfacing capabilities of the ARM Cortex-M microprocessors.
4. Exploit more of the programming aspects as they relate to the different hardware components.
5. Learn both hardware aspects along with existing software about memory design, GPIO, A/D and D/A converters, SPI, I2C, and Interrupts, all in relation to the ARM 32-bit microprocessors.
6. Learn the theory to conduct laboratory experiments that are based on a complete development board centered around the 32-bit ARM family microprocessor.
7. Identify ARM low power and sleep modes.
8. Learn about the hardware and software tradeoffs in digital design.
9. Develop embedded C/C++ programs and libraries for ARM Cortex-M3 processor, software flow, input/output and peripherals access.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
In this course the student will have to show
(a) an ability to apply knowledge of mathematics, science, and engineering (N/A)
(b) an ability to design and conduct experiments (simulations), as well as to analyze, interpret data (N/A)
(c) an ability to design a system, component, or process to meet desired needs (X)
(d) an ability to function in multi-disciplinary teams (N/A)
(e) an ability to identify, formulate, and solve engineering problems (homework) (X)
(f) an understanding of professional and ethical responsibility (N/A)
(g) an ability to communicate effectively (through project reports) (N/A)
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context (N/A)
(i) a recognition of the need, and an ability to engage in life-long learning (X)
(j) a knowledge of contemporary issues (X)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (X)
Brief list of the topics to be covered

1. Historical Background: Historical progression of ARM processor designs, processor classifications, features and levels of complexity.
2. mbed LPC1768 development board functions and features.
3. General Purpose I/O and principles of interfacing of Cortex-M microcontroller with input/output devices. GPIO alternate functions programming.
4. Analog to digital, digital to analog converters.
5. Embedded C/C++ programming
6. Serial communication protocols, SPI, I2C, and UART.
7. Interrupts: Interrupt handling, Interrupt inputs and pending behavior, NVIC for interrupt control, priority level, special registers for interrupts or interrupt masking.
8. General-purpose timers and timers programming.
9. Low Power Sleep modes.
10. Architecture of the ARM 32-bit Microprocessor: Registers, memory space and data organization, user and exception modes of operations.
11. Memory System: memory map, data alignment and unaligned data access support.
12. Writing library packages for an ARM processor.

GRADING:

Course Requirements                           Weight
Course project                                25%
Assignments                                  30%
Midterm Exams                                 15%
Final Exam                                    30%
Overall Grade                                 100%

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