

ME 477 Embedded Computing in Mechanical Systems

Department of Mechanical Engineering
University of Washington
Prof. Sawyer B. Fuller
Winter 2021 — **Version 1.0**

prerequisites: ME 374 Systems Dynamic Analysis and Design

textbook: *Any* introductory C language textbook. If you do not already have one, a good reference is Kernighan, B. W. and Ritchie, D. M., *The C Programming Language*. Prentice Hall, 2nd Ed. Englewood Cliffs, NJ, 1988.

webpage: <http://courses.washington.edu/mengr477>

experiments: There will be nine experiments, each requiring a brief report. Instead of physical experiments, for 2021 you will pick up or be mailed a kit.

experiment reports: Reports and homework are due on Canvas as a lab report (.pdf) and source code (.c) by **Friday at 8:00 pm**.

late reports: The grade will be reduced by 10% per workday late. A report submitted after 5:00 on Friday and before 5:00 Monday is one day late. The maximum late penalty is 50%. You must submit a report for each of the nine labs to pass this course.

exams: There will be one mid-term exam and a final.

grades: homework & labs, 45%
mid-term exam, 25%
final exam, 35%

first day: Monday, January 4, 2021

last day: Friday, Mar 12, 2021

final exam: 2:30-3:50 PM, Wed, March 17, 2021

Week	Subject	Suggested Reference
1	Introduction to Microcomputing - Number Systems: Binary, Octal, Hexadecimal, Conversions, - Arithmetic - Boolean algebra, Combinational logic - Memory and memory organization: - Physical Types, ROM, RAM, Dynamic, Static Handouts each week in bold are due the following week: homework #1 - binary arithmetic laboratory #0 - mechanics of embedded computing	Skim myRIO User Guide and Specification
2	Interpretation: Numbers, Codes, Instructions - NI myRIO-1900 Survey - Xilinx Zynq-7010 & ARM Cortex-A9 Architecture laboratory #1 - C language & machine language	Skim Chapter A2 of Arm Architecture Reference Manual
3	Review of C Language Programming - Variables, expressions, control, - Use of CDT; debugging. laboratory #2 - keypad & LCD primitive functions	Use any C language text as a reference
4	- The LCD and keypad hardware. - Data Input/Output: Programmed I/O, Interrupts - Serial & Parallel interfaces; Low-level drivers laboratory #3 - keypad & LCD low-level interface	myRIO Shipping Personality Reference: DIO, and myRIO User Guide: UART
5	- Instruction Timing - Parallel I/O - Pulse Modulation Techniques laboratory #4 - parallel input/output and control	Cortex-A9 Technical Reference Manual Appendix B
6	- Interrupt Driven I/O - Sources: Internal and External - POSIX threads laboratory #5 - external interrupts	myRIO Shipping Personality Reference: IRQ Digital Input interrupt
7	- Programmable Clocks and Timing - D/A & A/D Conversion - Digital Signal Theory laboratory #6 - D/A conversion and clock interrupts	myRIO Shipping Personality Reference: Timer interrupt Notes
8	- Serial I/O - Synchronous & Asynchronous laboratory #7 - dc-motor encoding & open-loop control	Notes
9	- Interface Devices - TTL Circuits. high-power switches, stepping Motors laboratory #8 - digital closed-loop control	Notes
10	- Other Processors - Bus Structures	