

ENGR 331 ---- Microprocessors 2

Spring 2009	4 Credit Course
Section 01	Monday, Wednesday, and Friday 9:35 to 10:40 AM Room OWS LL54
Section 51 (lab)	Tuesday 8:30 to 11:30 AM in OSS LL14
Section 52 (lab)	Thursday 8:30 to 11:30 AM in OSS LL14
Instructor	Dr. Jeffrey A. Jalkio 160 OWS Phone: (612) 962-5754 E-Mail: jajalkio@stthomas.edu
Texts	Embedded Design with the PIC18F452 Microcontroller, John B. Peatman, Prentice Hall Embedded C programming and the PIC Microcontroller, Barnett, Cox, and O’Cull, Thomson

Course Objectives for ENGR 331

1. Ability to interface microprocessors to common digital and analog peripherals.
2. Ability to design hardware/software systems for simple data acquisition and control applications
3. Ability to use software tools and lab instruments to design, simulate, build, test and document circuits using microprocessors and peripherals.

Course Outcomes for ENGR 331

(Codes in parentheses refer to program learning outcomes)

Skills

Upon successful completion of the course, the student will be able to:

1. Read and interpret microcontroller data sheets sufficiently well to use the processor effectively as demonstrated in lab reports, (EE2, 15)
2. Design, build, document and test software for simple data acquisition and control applications as demonstrated in lab reports, (EE1, 2, 3, 4, 6,12)
3. Design, build, document and test interface circuits for connecting common sensors and actuators to microcontrollers as demonstrated in lab reports (EE1, 2, 3, 4, 6,12)

Knowledge

Upon successful completion of the course, the student will be able to explain:

1. The function, initialization and use of common microcontroller peripherals such as timers, counters, digital I/O and analog I/O as demonstrated in lab reports and quizzes. (EE10)
2. A structured approach to design of embedded systems as demonstrated in a project (EE10, 12)
3. Analog issues inherent in digital system design, such as ground bounce, inductive load, undersampling, and noise as demonstrated in lab reports. (EE10)

Attitudes

During the course, the student must at all times exhibit:

1. Concern for the safety of themselves and others, as demonstrated by behavior in lab (EE13)
2. Efficient use of time and resources, as demonstrated by prompt completion of work and care of lab equipment (EE13)
3. Courtesy to classmates, faculty and staff, as demonstrated by tidiness in the lab (EE13)

Tentative Schedule for First Day of Class (2 Feb 2009)

<u>Date</u>	<u>Topic</u>	<u>Lab</u>
Feb 2	The PIC18 Architecture and an introduction to digital I/O	1- Intro to development environment
Feb 4	Macro Assemblers and more on the instruction set	
Feb 6	Control loops and timers	
Feb 9	Review of C	2-Digital I/O via software loops and timers
Feb 11	Rotary encoders and Gray code	
Feb 13	Interfacing to the LCD display	
Feb 16	Project Introductions	3-Combination Lock
Feb 18	Stepper Motors	
Feb 20	Stepper control	
Feb 23	Design Issues	4 – Stepper motor control
Feb 25	Projects, sensors and Frequency measurement	
Feb 27	Capture/Compare registers and pulse width modulation	
Mar 2	Time Interval Measurement and the Capture/Compare Registers	5-PWM output
Mar 4	Analog to digital conversion	
Mar 6	A to D continued	
Mar 9	Component Selection and Ordering	6 – Analog input
Mar 11	Timing Requirements and Interrupt Latency	
Mar 13	Interrupt Service Routines	
Mar 16	Timing comparison of different I/O techniques	7 – Interrupts
Mar 18	Serial Peripheral Interface	
Mar 20	Serial communications protocols	
Mar 23	Mid Term Break	
Mar 25	Mid Term Break	
Mar 27	Mid Term Break	

Mar 30	Debugging Software	8 - SPI
Apr 1	Debugging Hardware	
Apr 3	I2C and Multimaster systems	
Apr 6	I2C and Multimaster systems	9 – Project
Apr 8	Interrupt structure for communications	
Apr 10	The Microprocessor as circuit component and I/O Pin circuit considerations	
Apr 11	Good Friday	
Apr 13	Easter Monday	
Apr 15	System Fabrication	
Apr 17	Low power operation	
Apr 20	Low power operation continued	
Apr 22	System Design	
Apr 24	Device Configuration	
Apr 27	Oscillators	
Apr 29	Watchdog timer	
May 1	EEPROM	
May 4	Comparison with other microcontrollers	
May 6	Review	
May 8	Review	
May 11	Project Presentations	
May 13	Project Presentations	
May 15	Project Presentations	
Finals Week	Project Presentations	8:00-10:00 AM