

Sonoma State University
Engineering Science
Course Syllabus – Spring 2016

Course:	ES 310: Microprocessors & System Design Lecture & Lab: Salazar 2001	
Instructor:	Dr. Farid Farahmand Office: 2010 A Salazar Phone: (707) 664-3491 E-mail: farahman@sonoma.edu Web: http://www.sonoma.edu/users/f/farahman/	
Office Hours:	By Appointment – I am not available on Fridays and Mondays.	
Textbooks:	Required: Fundamentals of Microcontrollers And Applications in Embedded Systems With PIC	
References:	PIC Microcontroller by Muhammad Ali Mazidi, Rolin McKinlay, and Danny Causey. Applying PIC18 Microcontrollers: Architecture, Programming, and Interfacing using C and Assembly By B.B Bery Electronics Teach-In 2 (Reference #TI2)	
Required Material:	Hardware for your project	
Prerequisites:	ES 210: Digital Circuit & Logic Design ES 230: Electronics I ES 220/221: Electric Circuits	
Grading Plan:	Exams / Class Evaluation	30%
	Lab projects/homework	35%
	Final Project	5%
	Quiz / Articles	30%
Grading:	95 - 100 A	70 – 73 C-
	90 – 93 A-	77 – 79 C+
	87 – 89 B+	67 – 69 D+
	84 – 86 B	64 – 66 D
	80 – 83 B-	60 – 63 D-
	74 – 76 C	< 60 F

Reminder:

ES 310 is a 4 credit hour course requiring an average of 12 hours of study per week!

Note 1:

- 15 points deduction / day for each late assignment / Incomplete programs are not accepted.
- For each unexcused absence in the lab your *final* grade will be dropped by *three* points.

Course outline

Chapter 1 - Microprocessor and Microcontroller Fundamentals

Chapter 2 - Microcontroller Architecture—PIC18F Family

Chapter 3 - PIC18F Programming Model and Its Instruction Set

Chapter 4 - Programming and Problem Solving

Chapter 5 - Introduction to Data Copy (Move), Arithmetic, and Branch Instructions

Chapter 6 - Introduction to Logic, Bit Manipulation, and Multiply-Divide Operations

Chapter 7 - Stack and Subroutines

Chapter 8 - Application Programs and Software Design

Chapter 9 - Input/Output (I/O) Ports and Interfacing

Chapter 10 - Interrupts

Chapter 11 - Timers

Chapter 12 - Data Converters

Chapter 13 - Serial I/O 401

Tools and Software

- *MicrochipMPLAB®*
- *PIC18 Simulator IDE*
- *Matlab: <http://www.mathworks.com/>*
- *[The Proteus Design Suite](#)*
- *[MPLAB C for PIC18 v3.34 in LITE mode](#)*

POLICIES

CLASSROOM CONDUCTS: In order to create an appropriate environment for teaching and learning, students must show respect for their instructor and fellow students. Listed below are a few guidelines for classroom behavior. Students are expected to follow these rules to ensure that the learning environment is not compromised.

1. **Class Participation:** You are expected to be in class the entire class time. Please do not enter late or leave early. Rare exceptions may be made, particularly in emergency situations. Your participation in the class and lab and the discussions are very important and would help me understand how much you follow the material. As you go through the material before and after the class jot down your questions and ask me as I go through the slides.
2. **Absences:** Inform the instructor in advance, if you know you are going to miss a class. Also, take responsibility for getting missed assignments from other students. Your instructor is not responsible for re-teaching the material you missed due to an absence or being late.
3. **Conversation:** Do not carry on side conversations in class.
4. **Sleep:** Do not sleep in class.
5. **Internet browsing:** Please turn off all monitors/laptops and listen to lectures. Check your emails before coming to class!
6. **Attitude:** You are expected to maintain a civil attitude in class. You may not use inappropriate or offensive commentary or body language toward the instructor or fellow students.
7. **Cell phones:** You may not use your cell phone during class. Please turn off your cell phone upon entering the classroom.

PLAGIARISM: All forms of cheating and plagiarism are serious offenses that can result in disciplinary penalties including expulsion from the university. This includes copying assignments from the Internet! Refer to the student handbook for details.

WITHDRAWAL: No student will be granted a withdrawal after the deadline unless under extreme circumstances. Policy regarding withdrawal is stated in the university catalog.

SPECIAL NEEDS: Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs.

COURSE DESCRIPTION AND OBJECTIVES

The primary goal of this course is to give you the fundamental skills needed to understand, use, and design microcontroller-based systems. This includes the following: (1) What is a microcontroller? (2) What can it do (and not do)? (3) How does one design (and program) a microcontroller-based system? The course focuses on 8-bit PIC architecture. You will be using PIC18F46J50 chip.

At the conclusion of this course, the successful student will be able to:

- A. Gain a solid understanding of how microprocessors and microcontrollers operate.
- B. Demonstrate a working knowledge of the necessary steps and methods used to interface a microcomputer system to devices such as stepper motors, sensors, etc.
- C. Develop and demonstrate a structured assembly and C language program to accomplish a given task using a microcomputer.
- D. Demonstrate the use of interrupts and other programming techniques related to micro-controllers. Complete the design, development, programming, and testing of a microcomputer based project.
- E. Demonstrate a working knowledge of microcomputer busses and the flow of data within a microcomputer system.
- F. Be able to write professional product report.
- G. Be able to operate in team and work together towards a common goal.
Become a more self-motivated and self-learner individual.

IMPORTANT

The California Faculty Association is in the midst of a difficult contract dispute with management. It is possible that the faculty union will call a strike or other work stoppage this term. I will inform the class as soon as possible of any disruption to our class meeting schedule.

COURSE LEARNING OBJECTIVES (for ABET)

ES 310: Microprocessors & System Design

Lecture & Lab: Salazar 2008

Contribution of Course to Meeting the Professional Component:

Engineering topics: 100%

Math & Basic Science: 10%

General Education: 15%

ABET Student Outcomes	Course Learning Objectives	Level of Support
(a) an ability to apply knowledge of mathematics, science, and engineering	B, F	5
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	B, D, E, F	4
(c) an ability to design a system, component, or process to meet desired needs	B, E, F,G	3
(d) an ability to function on multi-disciplinary teams	G	2
(e) an ability to identify, formulate, and solve engineering problems	B, F	5
(f) an understanding of professional and ethical responsibility	C	2
(g) an ability to communicate effectively	B, F	3
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context	C, G	3
(i) a recognition of the need for, and an ability to engage in life-long learning	G	3
(j) a knowledge of contemporary issues	A	4
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	A-E	4
(a) an ability to apply knowledge of mathematics, science, and engineering	B, F	4
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	B, D, E, F	4

ASSIGNMENTS

HOMEWORK: All students are required to complete homework assignments. Homework assignments require familiarity with different software tools such as Excel, and VISIO. Homework assignments must be submitted in class. **Late submissions will receive 15 deduction points for each late day, including weekends.** All hardcopy submissions must be stapled and have a coversheet, otherwise they will *not* be accepted. Please avoid printing your homework when class starts! Unless specified in advance, no handwritten homework will be accepted.

DISCUSSION GROUP: Each individual student is required to have at least four entries into the class Piazza Discussion Group. Blog entries include answer to questions and responses to other students

DESIGN PROJECT: You are required to submit one final design project. All projects require prior approval from your instructor. Maximum of **two people per group** is allowed. It is encouraged to have a partner, however, each person must clearly identify what his/her contribution was. For each project you must submit an abstract at the time of presentation. The **abstract** must include group members (who is doing what), project idea, and objective of the project. The final design project must be functional and properly operate as intended. Here are some Design Project guidelines:

- In your project you must use at least **THREE** of the following features of the microcontroller: ADC/DAC/Communication ports / Interrupt / Watchdog / Feedback/EEROM / Display (one or two LEDs **are not** considered as display!)
- All projects must have at least TWO of the following functionalities:
 - Data logging (SD card, EPROM, etc.)
 - Sensor interface (GPS, accelerometer, Microphone, PWM, etc.) – simple ADC does not count!
 - Software Interface (Android, LabVIEW, etc.)
 - LCD or 7-Segment (graphical, color display, etc.) – Simple display of numbers does not count!
 - Communication (wireless, USB, Bluetooth, Serial, etc.)
 - Power saving mode (sleep mode, etc.)

Please note that projects such as simple dice, flashing LED, single tone generator, are **NOT** considered as good projects. For some interesting projects refer to [YouTube](#).

It is **strongly** suggested that you take full advantage of your Holidays to complete your project! Incomplete projects do **NOT** receive grades! Graduate students enrolled in the course are required to do more comprehensive final projects.

QUIZZES: There will be a quiz almost once a week. The quizzes will be based on practice/homework problems (but not exactly the same). No make-ups are allowed. If you are late to class or stepped outside and missed a quiz, there will be no make-up. You can drop your lowest quiz grade. Note that all quizzes are limited to no longer than 10-15 minutes.

LABS & PRE-LABS: Each student must submit the lab report individually and work independently. Please note that for each unexcused absence in the lab your *final* grade will be **dropped by three points**. All pre-labs must be typed, dated, and include student's name and ID; you receive any grade, otherwise. Lab submissions rules:

1. All figures must have caption (minimum of 30 words), and Figure number. Figures must be clear; add notes on the figure is necessary (see the posted Example!)
2. Questions must be included in the labs. If you only have answers, you will not receive any grades.
3. All submissions must have coversheet. The entire lab must be typed. All drawings must be done with computer.
4. All submitted codes must have comments; codes with no comments do not receive any grades.
5. The overall structure of the lab must be clear and well-done. You will receive negative points for having too much white space and wasting too much paper! (up to 5 points - seriously!)

EXAMS: Exams will consist of problems designed to test your understanding of the concepts covered in class and lab. Anyone missing an exam will receive a zero grade for that exam. Make-up exams will only be given with a doctor's slip stating that you were too ill on the day of the exam to attend, or documented extraordinary circumstances. Please note that exams may include in-class programming assignment. **NOTE:** In order to be able to take the final exam you are required to bring a snapshot of your Moodle indicating that you have completed the **class evaluations**. You **WILL NOT** be allowed to take the final exam if you do not bring a proof that you have completed the class evaluation.

LECTURE SERIES: If you attend a minimum of SIX lecture series, your lowest quiz grade will be dropped. Please return the signed form when you take your **final exam**.

ARTICLES: Each individual student is required to submit at least FOUR article *summery* related to the the class topics. Articles must be submitted electronically through Moodle or Piazza. Each article summary must describe the main point of the article/news along with proper citation. Four article submissions counts as one quiz grade. You may be asked to talk about your article in class.

FINAL PRESENTATION: Your project must fully function, as you described it in your abstract! In addition, you must submit all your codes, powerpoint slides, simulations results, and documents. Note that all projects must include **Schematic Capture** and **Simulation Results**. All submissions must be included in the CD. Please make sure you have a [CD sleeve](#). All CD folders must be compatible (readable) with Windows OS.

SOFTWARE

All students are expected to become skilled and comfortable with the following software: MS Word, MS Excel, and PowerPoint. You are also required to download and install the following software tools to complete your assignments:

- [MS VISIO](#)
- [Pro Schematic](#)
- [MicrochipMPLAB® ICD 2](#)
- [PIC18 Simulator IDE](#)
- Matlab <http://www.mathworks.com/>
- [The Proteus Design Suite](#)
- [MPLAB C for PIC18 v3.34 in LITE mode](#)
- [Eagle Schematic Capture](#)
- [MultiSim Blue](#) (free)
- [KiCad Tutorial](#)
- [Fritzing](#) - making schematic capture and PCB; also try [123D Circuits](#) from AutoDesk.
- Online circuit simulators ([PartSim](#) by Dig-Key, [CircuitLab](#), [DoCircuits](#), and many more...)

GENERAL GUIDELINES

- Quizzes on Mondays; almost every week!
- Labs/mini-projects/submissions on Mondays
- Wednesdays are makeup days

GRADING SUMMARY

Each student's final grade will be calculated according to the Grading Plan mentioned above. Please note the following:

1. All assignments must be submitted at the beginning of the class. They must be stapled and have a coversheet.
2. Late assignments (hardcopy or softcopy), including lab, pre-lab, homework, etc., will receive 15 deduction points for each late day, including weekends.
3. There will be no curving (89.2 is still a B+).
4. Best ways to lose points in homework and labs: forget about figure captions, don't include questions, submit late, forget about comments in your code, don't include the header in your code, don't include coversheet!
5. There will be no make-ups.
6. Quizzes will be given at the beginning of each class.
7. Pay attention to the grading plan!
8. Incomplete projects do **NOT** receive grades!

Please make sure you speak to me before you decide on dropping the class!

I will be available, if you are willing to learn!