

## **Syllabus: ESE280 Embedded Microcontroller Systems Design I**

Fall 24, K. Short      August 12, 2024 11:49 am

Lecture: Tuesdays and Thursdays 3:30 to 4:50 pm, Engineering room 143.

Laboratory: Light Engineering room 230.

Office Hours: TBD

### **Objectives**

Most electronic systems, ranging from trivial to extremely complex, are designed around an embedded microcontroller or an embedded microprocessor. This course presents the fundamental hardware and software concepts and methodologies used in the design of microcontroller based embedded systems.

### **Target Instructional Microcontroller**

The target microcontroller is the microcontroller a person uses as the basis for a particular embedded system design. This semester, we will be using an Atmel/Microchip AVR128DB48 as the target instructional microcontroller for this course. This microcontroller was chosen for a number of reasons. One is that a very simple and inexpensive circuit board, that can be programmed through a USB interface, is available for this microcontroller. This board is the AVR128DB48 Curiosity Nano.

### **Textbook**

Since the AVR128DB48 is a fairly new microcontroller, there are no textbooks that focus on this device. So, there will be no textbook for this course. Instead, the basic concepts of embedded system design and use of the AVR128DB48 in particular will be covered in the course lectures and reinforced by the laboratory assignments. This makes it critical that you attend the lectures for success in this course.

### **Other Reference Materials**

There are four primary reference documents used in this course:

1. AVR128DB48 Microcontroller Data Sheet
2. Atmel 8-bit Instruction Set
3. AVR Assembler 2017
4. Atmel Studio 7

The first three documents can be found on Brightspace under Course Documents > Atmel Documents. The other document is accessed through the Help tab in Studio 7. Many other useful documents will be made available to you on Brightspace.

The AVR128DB48 Data Sheet is your primary reference for understanding the operation of the microcontroller. This is a data sheet, not a tutorial document. You will be shown how to use it effectively and will eventually become comfortable with its use.

You should also have access to a good introductory digital logic design textbook to review the concepts from ESE118 that you will need in this course. Your textbook from ESE118 should suffice.

### **Brightspace**

You can access class information on-line at: <http://Brightspace.stonybrook.edu>. If you used Brightspace during the Spring semester, your login information (Username and Password) has not changed. If you have never used Stony Brook's Brightspace system, your initial password is your SOLAR ID# and your username is the same as your Stony Brook username, which is generally your first initial and the first 7 letters of your last name.

For problems logging in to Brightspace, go to the helpdesk in the Main Library SINC Site. You can also call: 631-632-9602 or e-mail: [helpme@stonybrook.edu](mailto:helpme@stonybrook.edu).

### **Lecture**

The purpose of the course lectures is to clarify and extend concepts from the reading assignments and to elaborate on concepts required for the laboratory design work. Lectures are held from 3:30 to 4:50 pm on Tuesdays and Thursdays in room 143 of the Engineering Building.

Lectures are presented in a manner that assumes you have completed all assigned reading prior to the lecture. A weekly reading assignment list is provided as part of the Schedule on Brightspace. Reading assignments are taken primarily from the reference material that is available on Brightspace, Microchip's web site (<https://www.microchip.com>), or Studio 7's Help files. Copies of the PowerPoint presentations used in the lectures are also be available on Brightspace.

## Atmel Studio 7

The software development environment used in this course is Atmel Studio 7. Programs for this course are written in assembly language so that you gain a clear understanding of the microcontroller's architecture and operation. Studio provides an assembler and an emulator for developing and debugging programs for Atmel's AVR family of microcontrollers, including the AVR128DB48. You must download and install a copy of the Studio 7 software to your computer from Microchip's web site. A link to the appropriate web page is provided on Brightspace under Documents > ATMEL STUDIO 7.x. Atmel Studio is also available for your use in the Embedded Systems Design Laboratory and the ECE CAD Laboratory.

## Laboratory

We hope to start laboratory sessions the second week of classes, the week beginning September 1st. During your first assigned laboratory section meeting you will be given an orientation to the operation and procedures of the Embedded Systems Design Laboratory (ESDL) and receive your laboratory computer account. An understanding of the information given in this orientation is critical to your success in the laboratory portion of this course. Please be sure to not miss your first laboratory session and to be there on time.

You must be registered for and attend one of the following three-hour scheduled laboratory sections:

Lab. Sec. 1	Wednesday	8:00 to 10:50 am
Lab. Sec. 2	Wednesday	2:00 to 4:50 pm
Lab. Sec. 3	Thursday	8:00 to 10:50 am
Lab. Sec. 4	Friday	8:00 to 10:50 am
Lab. Sec. 5	Friday	2:00 to 4:50 pm

Laboratory sections meet once a week in the Embedded Systems Design Laboratory (ESDL) in rooms 228 and 230 of the Light Engineering building. **Starting the week beginning September 1st, you must be present in your assigned laboratory section at its scheduled starting time.**

Your first laboratory session consists of an orientation to the laboratory and its policies and the performance of some simple laboratory tasks. **Attendance during the first laboratory session, as with all laboratory sessions, is mandatory.**

Laboratory assignments are generally provided at least one week before you must perform them. Except for the first week of laboratory, a portion of your pre-laboratory work must be electronically submitted the evening before your assigned laboratory section meets. **Your completed laboratory report must be submitted, to your TA, by the end of your laboratory section. No work is accepted late. Due to staff and equipment limitations, it is not possible for you to make up missed laboratory work. Your lowest lab grade from the first seven laboratories is dropped from your laboratory average to allow you to miss one laboratory without much consequence.**

## Grading

Three exams will be given. Exams cover lecture, laboratory, and reading material. Exam dates listed are tentative. Your course grade will be computed based on the following weighting:

<b>Exams</b>	<b>60%</b>
1.	Tuesday, September 24th
2.	Thursday, October 24th, and
3.	Thursday, November 21st
Makeup Final	Tuesday, December 17th (5:30 to 8:00 pm)

## **Laboratory 40%**

There are three required exams, Exams 1, 2, and 3. If you miss any one of these exams, for any reason, you must take the comprehensive makeup final. Your grade on the Makeup Final will replace a single missing exam grade. If you miss two or more exams, your Makeup Final grade replaces only a single exam grade. Other missed exam grades will be 0s. The Makeup Final Exam will be comprehensive and more difficult than Exams 1, 2, and 3.

**If you don't miss any exams, you cannot take the Makeup Final Exam.**

Any issues you have regarding the grading of an exam or laboratory must be resolved within one week from the day the graded work is made available for return to you in your laboratory section. **After one week, no grade changes will be made for any reason!!!**

## **Being Successful in this Course**

Your grade is based on your performance in exams and laboratories. A lot of material is covered in this course and much of it is rather detailed. Both hardware and software concepts are initially introduced at a very basic level to accommodate those who are completely new to the material. However, the ramp up in level is significant as the semester progresses.

You need to master new concepts in a very short time after they are presented in class. If you have difficulty in understanding any of the course material, please get help from the teaching assistants or instructor as soon as possible. **You need to apply yourself from the start and continue to apply yourself throughout the semester. If you wait until later in the semester to get needed assistance, it will most likely be too late.**

## **Required Syllabus Statements**

The University Senate Undergraduate and Graduate Councils have authorized that the following required statements appear in all teaching syllabi (graduate and undergraduate courses) on the Stony Brook Campus:

### **Student Accessibility Support Center Statement**

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at [sasc@stonybrook.edu](mailto:sasc@stonybrook.edu). They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

### **Academic Integrity Statement**

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Professions, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at [http://www.stonybrook.edu/com-mcms/academic\\_integrity/index.html](http://www.stonybrook.edu/com-mcms/academic_integrity/index.html)

### **Critical Incident Management**

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.