

Embedded Systems Laboratory – ENGR 423, Section 01

Abilene Christian University

Credit Hours: 1

Semester and Year: Spring 2016

Pre-requisites/co-requisite: ENGR 210/211 (Digital Logic/Lab), ENGR 422 is a co-requisite.

Class Meeting Times and Location

This class meets for laboratory sessions on Wednesdays from 2:00 pm to 4:50 pm in Foster Science Building 327. The associated class meets Monday, Wednesday, and Friday from 8:00 a.m. to 8:50 a.m. in Foster Science Building 350.

Required Text and Software

There is no text required for the laboratory portion of the course. Students may want to access the online book, *The Zynq Book* at www.zynqbook.com. The text for the lecture portion of the course is *ARM Assembly Language: Fundamentals and Techniques*, 2nd edition, by William Hohl and Christopher Hinds, CRC Press, 2015, ISBN 9781482229851.

Catalog Description

This laboratory course addresses the practical implementation of algorithms in C and assembly language programming, debugging, power supply design, and interfacing sensors, displays, and motors to microcontrollers. Prerequisites: ENGR 210/211. Concurrent enrollment in ENGR 422 is required. (1 hour)

Intended Audience

This is an elective course for engineering majors and intended to be completed during their junior or senior year. Non-majors interested in developing technical skills in embedded systems may also enroll in the course. Competency in advanced mathematics and calculus-based physics is required for all students.

Contact Information

Name:

Office:

Phone:

Email:

Office Hours

MWF 9:00 am to 11:00 am

TR 8:00 am to 10:00 am

TEACHING PHILOSOPHY

Engineering is a well-respected profession. The public entrusts engineers to be honest, competent, and ethical. Many codes of ethics for these fields indicate that the commitment to protecting the health, safety, and welfare of the public is of paramount importance. These values are in harmony with Christian principles and ideals. Christian engineers should be honest (Matthew 5:37), work hard to ensure competency (Colossians 3:23), and put the public's interest ahead of his or her own (Luke 6:31). In light of these principles, this course will be taught such that you will gain an appreciation for the professional nature of engineering. It will be taught so as to give you every opportunity to begin to develop competency in these fields. This will require homework, quizzes, test, and group discussion. The instructor especially encourages the discussion of topics that would bear on integrating faith and professional responsibilities (cheating on licensure exams, weapons design and manufacture, environmental laws and employment opportunities in developing nations, etc.)

Learning Objectives

The activities of the course support the assessment of the following ABET Outcomes:

Criterion 3

3(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

3(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

ABET Learning Objectives	Course Competencies	Measurement
3(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	Design algorithms in C and assembly language	Labs 1, 2, and 7
	Interface electronic hardware to microcontroller board	Labs 11, 12, 13, 14, and 15
3(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Use an integrated development environment such as Eclipse, Keil, or Code Composer to program and debug microcontroller code	Labs 6, 7,
	Model electrical circuits in software such as Multisim to validate performance characteristics	Labs 3, 4, and 5

ACADEMIC INTEGRITY POLICY

Academic integrity is defined as academic work completed as assigned for each class by the individual or group responsible for the work. Violations of academic integrity and other forms of cheating involve the intention to deceive, mislead, or misrepresent and therefore, are a form of lying. Such actions are contrary to behavioral norms that flow from the nature of God. Academic misconduct includes, but is not limited to, the following: 1) Failure to give credit to sources used in a work in an attempt to present the work as one's own, 2) Submission of papers or projects obtained from another source (e.g., research service or club

paper file) as one's own, and 3) Falsifying information orally or in writing. Academic misconduct may result in, but is not limited to, a zero on the assignment and/or an F in the course. Additionally, the department chair, Dean of the College of Arts and Sciences, and the Dean of Student Life will be notified. See the full university policy, including how to appeal a decision, by following this link: <http://www.acu.edu/campusoffices/studentlife/judicialDocuments/AcademicIntegrityPolicy.pdf>.

ATTENDANCE

Attendance is expected at all class sessions. It is also expected that you arrive promptly. If you are absent or tardy it may be difficult to complete the lab, and may result in a lower grade or zero if the lab is uncompleted.

GRADING POLICY

Attendance

Attendance is expected at all lectures. Pre-excused absences will be granted for official representations of Abilene Christian University, bona fide illness, death in the family, or other reasons deemed appropriate by the professor. Excessive absenteeism, defined as more than one unexcused absence, may result in a grade reduction or withdrawal from the course with a grade of F. Because ENGR 422 and ENGR 423 are co-requisites of one another, withdrawal from one will require withdrawal from the other.

-Laboratory Sessions and Reports

Attendance at all laboratory sessions is expected. Lab reports will generally consist of demonstrating a successful lab (80% of lab report grade) and the completion of flow charts, assembly language code, and simulation results (20% of lab grade). Unless otherwise noted, labs will be due at the end of the laboratory period. Lab demos up to 48 hours late from the due date and due time will be accepted for 75% credit. Lab demos up to one week late will be accepted for 50% credit. No credit will be given for labs more than one week late. Labs will generally build upon each other and will be integrated together for the final exam portion of the lab. Thus, even if you do not get credit for the weekly lab, you must still complete it in order to successfully integrate it into the final exam for the lab portion of the course.

The final for the lab portion of the course will consist of you successfully demonstrating control of your quadcopter with the NI myRIO. Specifications for the quadcopter control will be delivered later in the course.

-Calculation of Final Course Grade

The final course grade will be weighted and assigned as follows*:

Lab Grade for Course

Weekly Labs.	80%
Final Lab Demonstration	20%

90% and above	A
80% - 89%	B
70% - 79%	C

60% - 69%	D
59% and below	F

*The instructor reserves the right to decrease the lower bound of the grade brackets.

ADA COMPLIANCE STATEMENT

“Abilene Christian University is dedicated to removing barriers and opening access for students with disabilities in compliance with ADA and Section 504 of the Rehabilitation Act. The Alpha Scholars Program facilitates disability accommodations in cooperation with instructors. In order to receive accommodations, you must be registered with Alpha Scholars Program, and you must complete a specific request for each class in which you need accommodations. If you have a documented disability and wish to discuss academic accommodations, please call our office directly at 325-674-2667.”

THE MISSION OF ACU:

To educate students for Christian service and leadership throughout the world.

THE MISSION OF THE COLLEGE OF ARTS AND SCIENCES:

The College of Arts and Sciences engages students with humanity’s greatest ideas to create understanding, apply insights, and serve the world as Christian thinkers and problem solvers.

THE MISSION OF THE ENGINEERING AND PHYSICS DEPARTMENT:

The ACU engineering program strongly supports the university's mission of educating students for Christian service and leadership throughout the world. In support of this mission, ACU engineering graduates will attain:

- a deep and broad understanding of engineering principles and practices as evidenced by professional employment, continued professional development, and graduate study in engineering or other professional fields.
- an extensive knowledge of the innovative design processes unique to engineering professionals as demonstrated by using critical thinking skills to contribute to the scientific and technical literature, patents and intellectual property, professional societies, and creative designs.
- a thorough understanding of Christian service and leadership as shown in their commitments to professionalism, ethics, and service and leadership within the engineering profession, the church, and society.

COURSE SCHEDULE

Week	Date	Topics/Activities	Assignment Due Date
1	1/13/2016	Programming Fundamentals Lab	1/20/2016
2	1/20/2016	Programming in C Lab	1/27/2016
3	1/27/2016	Linear Voltage Regulator Lab	2/3/2016
4	2/3/2016	Switching Voltage Regulator Lab	2/10/2016
5	2/10/2016	Low Battery Indicator Lab	2/17/2016
6	2/17/2016	Eclipse Tutorial Lab	2/24/2016
7	2/24/2016	Programming MyRIO Lab	3/2/2016
8	3/2/2016	Quadcopter Build Lab 1	3/9/2016
9	3/9/2016	Quadcopter Build Lab 2	3/23/2016
10	3/23/2016	Quadcopter Build Lab 3	3/30/2016
11	3/30/2016	MyRIO Interface to LCD LOab	4/6/2016
12	4/6/2016	MyRIO PWM Interface to Motors Lab	4/13/2016
13	4/13/2016	MyRIO Quadcopter Interface Lab	4/20/2016
14	4/20/2016	MyRIO Quadcopter Control Lab	4/27/2016
15	4/27/2016	MyRio Quadcopter Final Demonstration Lab	4/29/2016

Instructor reserves the right to modify the course schedule as necessary