Digital Systems Design

The University of Toledo
Electrical Engineering Technology
EET 3350

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Office Hours: Tues. and Thurs. 9.30AM-12PM
Office Location: NE 1624
Instructor Phone: 419-530-3896
Offered: Spring 2019

Class Location: PL3120
Class Day/Time: M,W/2:30PM-3:50PM
Lab Location: NE2350
Lab Day/Time: Section002:M / 11:10AM-12:55PM
Section003:M/ 12:56PM-2:25PM
Credit Hours: 4 (Lecture: 3hours, Lab:2 hours)

CATALOG/COURSE DESCRIPTION

This course covers different aspects of real-time embedded systems implementation with low-level access to hardware resources of microcontrollers. Topics include but not limited to low-level and high-level microcontroller programming covering assembly and C, I/O access, interrupt-driven programming, timers, serial interfacing, analog-to-digital (ADC), and digital-to-analog (DAC). Uses system design approach, such as flow charts, finite state machines (FSM) while implementing embedded systems is emphasized.

COURSE STATEMENT

Embedded systems are ubiquitous nowadays. The overall course objective is to help the students to understand how embedded systems interact with the external world environment. The course aims to provide hands-on experiences of how an embedded system could be used to solve some daily life problems through automation. The focus will be given to understand basic building blocks of an embedded system instead of complex system design.

The final project will demonstrate the students' ability to identify a problem in society, work as a team to find a solution that uses an embedded system, and evaluate the cost of their solution vs. current technology. The students will then design and build an embedded system prototype using the concepts learned throughout the course, make an oral presentation, a video, and a report in order to explain the solution and its impacts. The final project has an emphasis on the process of coming together as a team with students from diverse background and it introduces students to the need for continuing professional development outside of the classroom.

STUDENT LEARNING OUTCOMES

Outcome a) an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly defined engineering technology activities;

Outcome b) an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;

Outcome c) an ability to conduct standard test and measurements; to conduct, analyze and interpret experiments; and apply experimental results to improve processes;

Outcome d) an ability to design systems, components, or processes for broadly – defined engineering technology problems appropriate to program educational objectives;

Outcome e) an ability to function effectively as a member or a leader on a technical team;

Outcome f) an ability to identify, analyze, and solve broadly – defined engineering technology problems;

Outcome g) an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;

Outcome h) an understanding of the need for and an ability to engage in self – directed continuing professional development;

Outcome i) an understand of and a commitment to address professional and ethical responsibilities including a respect for diversity;

Outcome j) a knowledge of the impact of engineering technology solutions in a societal and global context; and

Outcome k) a commitment to quality, timeliness and continuous improvement.an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;

PHILOSOPHY OF TEACHING (TEACHING METHODOLOGY)

This is an active learning course that will require students to be fully engaged. Face-to-face instructions in lectures will provide maximum help to students. Homework, quizzes, and comprehensive tests will be given. Laboratory sessions are used to reinforce digital logic design

concepts. The purpose of this course is to help students understand the fundamental embedded system design theories and use those theories to solve the relevant problems. Students are welcome to ask questions and discuss problems. The course will be instructed based on the philosophy of cycling education:

- through the theory to understand the formula
- through the usage of formulae to understand examples
- through the examples to solve similar exercise problems
- through face-to-face instruction to improve learning efficiency
- through lab guides reinforcement of principles provided in lecture
- through exams to emphasize importance and clarify confusion
- through taking this course to have the capability to self-study for future work or research

Recommendations for success:

- Come to lectures and take notes
- Read the relevant contents in the textbook
- Solve examples in the textbook and do homework
- Review the relevant contents and homework before each test or exam
- Read the relevant contents and prepare the lab experiment prior to going to the lab
- Take ownership of your learning. You are responsible for troubleshooting your prototype until it works.

Never hesitate to ask for help from the instructor.

PREREQUISITES AND COREQUISITES

(EET-2210 and EET 3150) or (EET 2210 and CSET 2230)

REQUIRED INSTRUCTIONAL MATERIALS (TEXTS AND ANCILLARY MATERIALS)

Free eBook online at http://users.ece.utexas.edu/~valvano/Volume1/E-Book/

$12.99 Launchpad Stellaris http://www.iar.com or Tiva http://www.ti.com/tool/ek-tm4c123gxl

TECHNOLOGY EXPECTATIONS

Web assist - Blackboard http://blackboard.utdl.edu/

Web assist – http://DrMubenga.com/

Applications- PowerPoint, Words

Language- Assembly Language (CSET), C language (EET)

UNIVERSITY POLICIES

Academic Accommodations

The University of Toledo is committed to providing equal opportunity and access to the educational experience through the provision of reasonable accommodations. For students who have an accommodations memo from Student Disability Services, it is essential that you correspond with me as

soon as possible to discuss your disability-related accommodation needs for this course. For students not registered with Student Disability Services who would like information regarding eligibility for academic accommodations due to barriers associated with a potential disability, please contact the Student Disability Services Office.

COURSE EXPECTATIONS

1. *All assignments including homework are graded based on correctness.*
2. *All assignments are to be completed on time and turned in at the beginning of the class/lab.*
3. *You are responsible for all materials covered in class as well as the material assigned in the book.*
4. *There is no make-up quiz, exams or homework for this course.*
5. *Cheating and Academic dishonesty is not allowed and will be punished by rules of University of Toledo Student Handbook. Read this http://www.utoledo.edu/policies/academic/undergraduate/pdfs/3364-7104%20%20Academic%20dishonesty.pdf*

Electronica Policy: No electronic items: cellular telephones, Blackberrys, personal digital assistants, digital music players or similar items that may disrupt the learning environment may be used at any time for any purpose during the classroom or laboratory time. If a cell phone must be kept on due to a potential emergency situation, it must be on a silent setting. If an emergency call must be taken during a class, the student must leave the classroom prior to answering the call and not return until the call is completed. See also Article IV.B Conduct Rules and Regulations of the Student Code of Conduct at the University of Toledo.

Readings: Reading for the course is shown on the accompanying handout. Readings are to be completed prior to the lecture and lab portions of the class.

If there is a conflict or misunderstanding, please see me privately to work out a resolution.

OVERVIEW OF COURSE GRADE ASSIGNMENT

Midterm Grading
Midterm grades will be presented per university requirements and based on the current updated cumulative scores obtained by the students usually the first 5 or 6 weeks.

Final Grading
A >= 90, B >= 80, C > = 70, D > = 60

Overall: *Homework 6%, Quizzes 12%, Lab 35 %, Project 20%, Test1 12%, Final Exam 15 %(Comprehensive)*

Details are shown in the following table.

Assignment	Weight for each	Nbr. of assignments	Overall
Homework	1%	6	6%
Quiz	2%	6	12%
Lab reports	5%	7	35%
Final Project	20%	1	20%
Test	12%	1	12%
Final Exam	15%	1	15%
Total:			100%

Grading for missed assignment due to an emergency: For missed assignments due to an emergency or a foreseeable event, students must fill out the missed assignments form and email the form along with written documentations from a 3rd party. **The missed assignment form must be emailed to the instructor on Wednesday April 10, 2019.** Final exam grade will be used in lieu of the missed assignment to calculate final grading.

Late lab reports will be accepted with a reduction of 20% per day.

Extra credit work will be given during the semester.

Both the midterm and final grading use the same formula, scale, and weights.

COURSE GUIDELINES

Please use your UT student email address (XX@Rockets.Utoledo.edu) for all your communications. The subject line must be***: EEC3350 LastName Keyword***. E.g: subject: EEC3350 Mubenga Homework4.All others type of email address will go directly to Junk E-mail folder.

Homework assignments are accepted only before or on the assigned day. Homework is graded on correctness. The final answer alone is not enough to get credit. Solution steps must be shown to get credit.

When not done in person, preferred communication between the instructor and students will take place via BlackBoard and email to a student's Rocket email address. While the instructor will not communicate via email on a regular basis throughout the semester, it is advisable that students check their BlackBoard and email regularly so as to keep abreast of any special instructions, clarifications on assignments or cancellations that may occur during the term

SAFETY AND HEALTH SERVICES FOR UT STUDENTS

http://www.utoledo.edu/offices/provost/utc/docs/CampusHealthSafetyContacts.pdf

COURSE, ASSIGNMENTS, AND HANDS-ON ACTIVITIES SCHEDULES

No Class Dates: Jan 21, March 4-8.

Test Date: Wednesday, February 20, 2019 2.30PM-3.50PM

Final Exam Date: Monday April 29, 2019 2.45PM-4.45PM

Tentative Course Schedule (Subject to Change depending on the course progress)

Week No.	Course Content	Assessments
1	Embedded Systems, Embedded System Architecture	Homework
2	Digital Logic	Quiz
3	ARM Machine Language, Assembly and C language programming	Homework, Lab
4	I/O Port Interfacing	Quiz, Lab
5	Switches and LED Interfacing	Homework, Lab
6	Review	Test
7	Software Design and Development	Quiz, Lab
8	**NO CLASS- SPRING BREAK**	
9	Array and Functionnal Debugging	Homework, Lab
10	Finite State Automation , Phase-Lock-Loop	Quiz, Lab
11	Serial communication UART	Homework, Lab
12	I/O Synchronization & Interrupts	Homework and Quiz
13	Analog/Digital Conversion (ADC and DAC)	Quiz
14	Team work, project management	
15		Final Project
16		Final Test

Tentative Assignment Schedule (Subject to Change depending on the course progress)

Date	Week	Reading assignment	Test	Homework on	posted on	due on	Quiz on	due Wed.
14-Jan	1	chap 2, 3		ch2/3	14-Jan	16-Jan		
21-Jan	2	chap 4					ch 2/3	1/23/2019
28-Jan	3	chap 5		ch4/5	28-Jan	4-Feb		
4-Feb	4	chap 6					ch4/5	2/6/2019
11-Feb	5	chap 6/8		ch6/8	11-Feb	18-Feb		
18-Feb	6	Review	**Test**					
25-Feb	7	chap 8/ 7					ch6/8	27-Feb
4-Mar	**8**	**NO CLASS**						
11-Mar	9	9.1-9.5		ch7/9	11-Mar	18-Mar		
18-Mar	10	10.1-10.5					ch7/9	20-Mar
25-Mar	11	11.1-11.5		ch10/11	25-Mar	1-Apr		
1-Apr	12	chap 12/13		ch12/13	1-Apr	8-Apr	ch10/11	3-Apr
8-Apr	13	14 + Review					ch12/13	10-Apr
15-Apr	14	Team Mtg.						
22-Apr	15	Presentations						
29-Apr	16		**Final**					

Tentative Hands-on Activities Schedule (Subject to Change depending on the course progress)

Date	Lab	Team Final Project Items/ Due date
14-Jan	Lab orientation, safety, and team	
21-Jan	NO LAB	
28-Jan	NXT 2.0 Lab: Build and program robot	Team (5 max), problem, topic, project plan/30-Jan
4-Feb	Lab 0 : Intro to Keil and TM4C123	
11-Feb	Lab 1: Simulated i/o interface	
18-Feb		
25-Feb	Lab 2 : Hardware i/o interface	Backgnd, pseudocode, flowchart, cost, parts list/27-Feb
4-Mar	**SPRING BREAK- NO LAB**	
11-Mar	Lab 3: LED interface / Panic button	
18-Mar	Lab 4: Switch +LED	Simulation, electric circuit drawing /20-Mar
25-Mar	Lab5:Traffic lights	
1-Apr		
8-Apr		Selection of presentation time
15-Apr	Mandatory Team Meeting	Mandatory Team Meeting
22-Apr	Final Project Presentation + Report	Final Project Presentation + Report/ 22-Apr
29-Apr		

I have received and read the syllabus.

Printed Student Name…….

Signature……Date……..