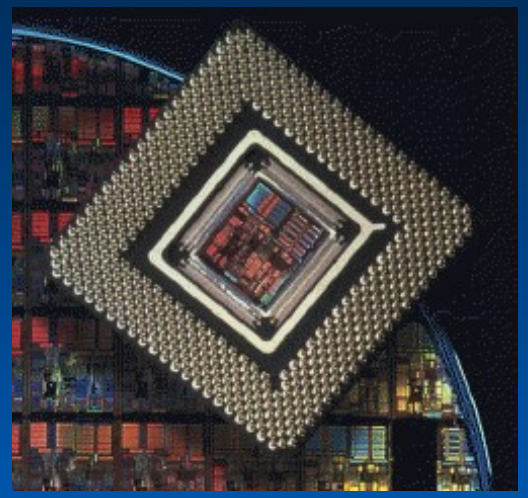


Microprocessor Systems and Interfacing

ECE 362 Course Introduction

https://engineering.purdue.edu/ece362/

Important Things To Do Today

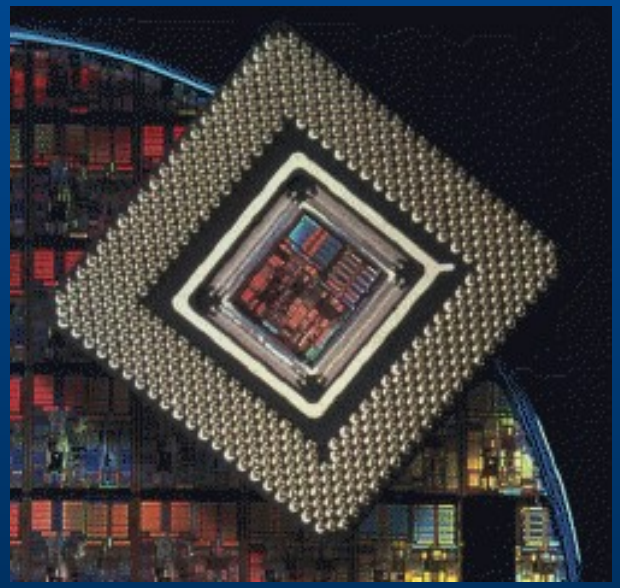
- **Ensure you have each of the following:**
  - **a lab development kit**
  - **an ECE master lab kit**
  - **a textbook**
  - **a Digilent Analog Discovery 2**

- **Details are on the ECE 362 website**

  https://engineering.purdue.edu/ece362

Your Instructor

- **Rick Kennell**
- **EE degrees from Purdue**
  - **I took 362 as a student**
- **Taught classes as a grad student**
  - **362, as well as 264, 364 and 437**
- **Worked in the microprocessor industry**
  - **World's fastest microprocessor (in 1997). DEC Alpha 21264.**
- **I'm now a Lecturer for ECE**
  - **I'm teaching 270 too.**



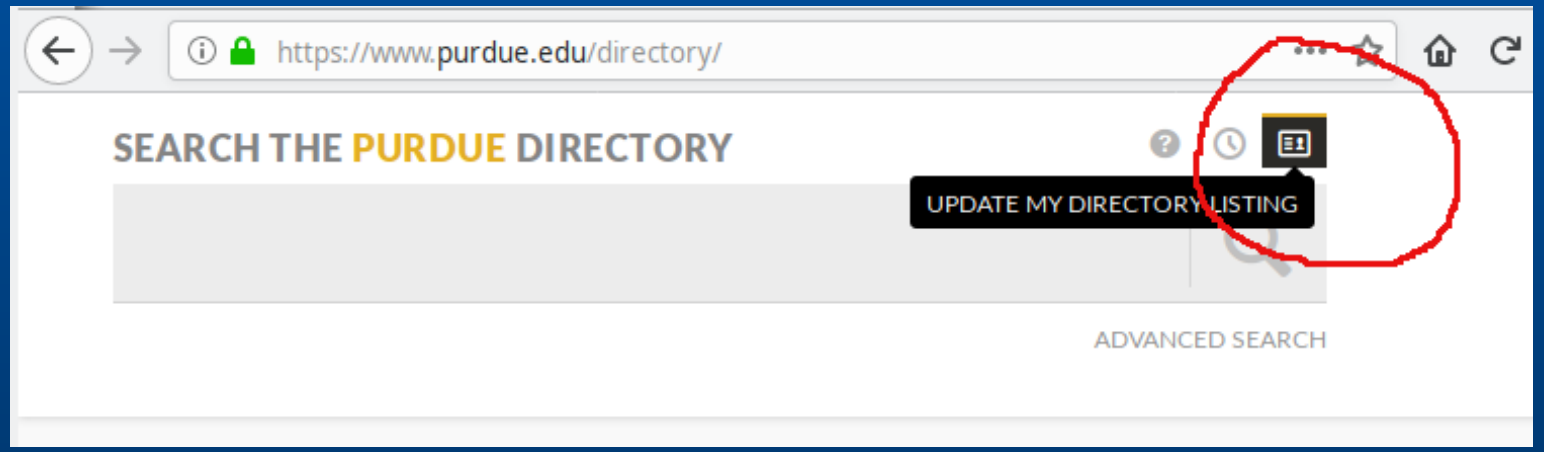
Your Instructor's Contact Information

E-mail: Rick@purdue.edu
Office: EE 252
Hours: W/F 1:00pm-3:00pm

https://engineering.purdue.edu/ece362/

How did I get that e-mail address?

- **Look at** **https://directory.purdue.edu/**
- **Click on icon to UPDATE MY DIRECTORY LISTING.**



How did I get that e-mail address?

Change Directory Information for ***richard l kennell***

Field Info	Field Value	Change Value
alias	kennell	**Change alias**
building	ee	University Records
campus	west lafayette	University Records
comment	*Not present in entry.*	**Change comment**
department	electrical and computer eng	University Records
email	rick@purdue.edu	**Change email**
fax	*Not present in entry.*	**Change fax**
lastname	kennell	University Records
name	richard l kennell	University Records
nickname	Rick	**Change nickname**
office	EE 252	**Change office**

- **You still keep the e-mail address that was picked for you.**
  - **You can still send e-mail to "kennell" if you spell it right.**
- **Add an e-mail address that's something you actually want.**
  - **Can be more than 8 characters.**
  - **Choose responsibly.**

Please reserve e-mail for emergencies

- **I have ~550 students this semester**
  - **You must contact your teaching assistant first**
  - **If you must contact me about ECE 362, send it to ece362@ecn.purdue.edu**
    - **Still delivered to me, but sorted differently**
    - **You might not ever hear anything back**
    - **Do not send the same thing twice**

Some reasons to contact or not contact

- If you are in the API program:
  - You will follow the instructions on the course web page (which differ from your paper form)
  - You will not send e-mail about this
- If you have DRC accommodations:
  - I do want to communicate with you personally
    - Please stop by my office hours or use Zoom
  - I do not want more e-mail from the DRC

Instructor Office Hours

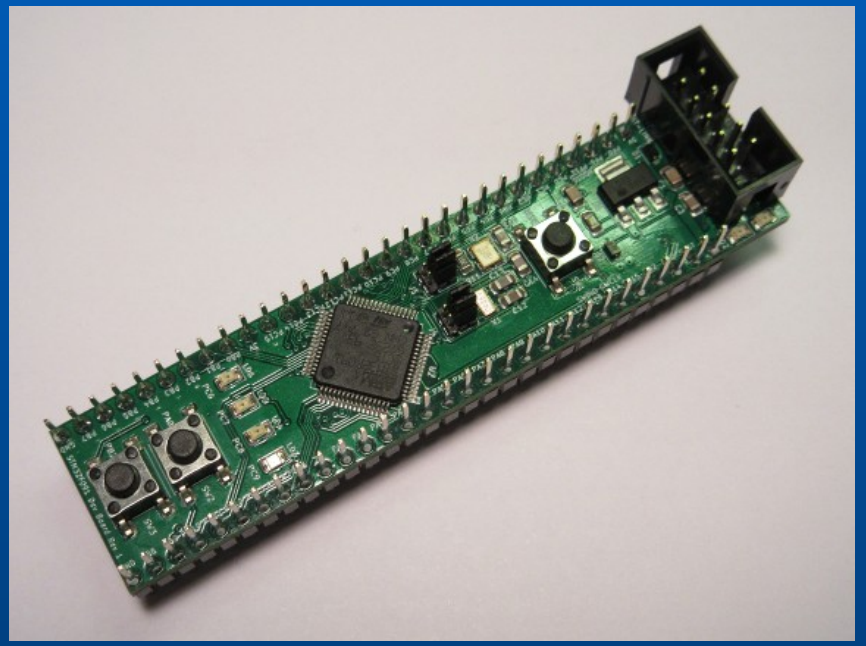
- W/F 1-3pm AND any time my door is ajar.
  - Also, hopefully, via Zoom.

Mental Health Statement

- **If you are suffering the effects of stress or anxiety, or you feel overwhelmed, you owe it to yourself to get help**
  - **And no one is going to blame you for that this semester**
  - **If the only thing standing between you and the help you need is the stigma of being "labeled", I want you to remember something:**
    - **Isaac Newton experienced a nervous breakdown in 1693**
  - **See the course policy and procedures document for more information**

Course Description

- Introduction to (“small memory model”) *control-oriented* microcontroller software, hardware, and interfacing
- Emphasis: basic computer engineering concepts
- Not a course about “personal” or general-purpose computers, but rather about *embedded microcontrollers*



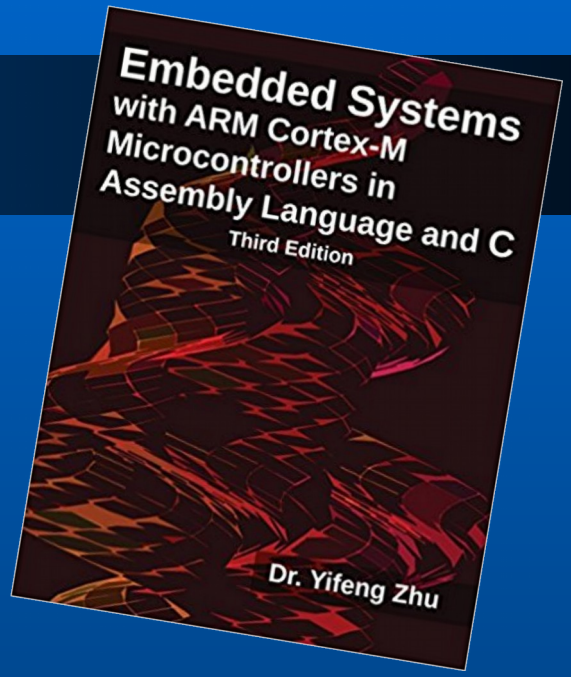
Purpose

- To provide an introduction to
  - microcontrollers,
  - assembly language programming techniques,
  - interface hardware design,
  - embedded system design,
  - and general computer engineering concepts

Prerequisites

- Course on high-level language programming
  - (Purdue equivalent: CS 159)
- Course on digital logic design
  - (Purdue equivalent: ECE 270)

Course Text and Documents



REFERENCE TEXT:

- *Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C (3rd Ed)*, Yifeng Zhu, ISBN 978-0-9826926-6-0

DOCUMENTATION:

- Many reference manuals on the course web page.

Lecture Notes

- Lectures will always be *as interesting as possible*, and will have many examples and demonstrations.
  - Lecture Notes will normally be on the course web page at some point before each lecture, and I'm told they are a decent substitute for going to class.
  - Lecture attendance is essential if you want to understand the material.
- We'll use i<Clicker questions to check your understanding as well as your *engagement*.

Simple rules for lecture

- Do not arrive late. If you do, I will tell you to leave and wait for you to go.
- Do not talk unless you're asking or answering a question (or, more likely, laughing at something I said). If you do, I will tell you to leave and wait for you to go.
- Do not leave before the lecture is over.
- Do not record lecture materials without permission.

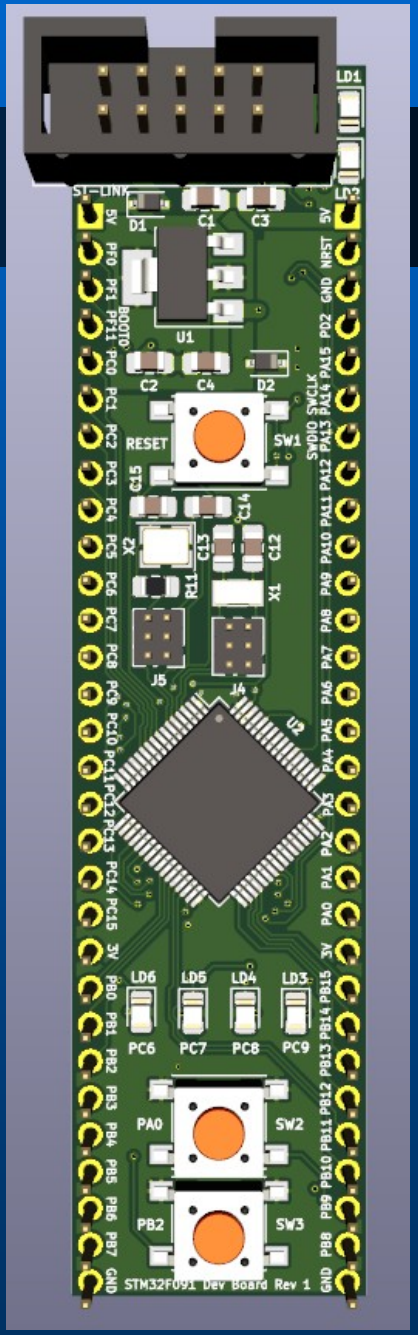
Lab Kits and Materials

You will need to purchase an *ECE 362 Lab Kit* (which includes a variety of interfacing components) from *Technological Arts* for your *lab 0 (this week)*

- *Follow the link provided on course website Message Board immediately.*
- *If you do not have your own lab kit and microcontroller, you will not be able to do any lab*

OTHER MATERIALS:

- *You also need a master lab kit*
- *For lab 6 and later, you will need a Digilent AD2*



Course Calendar

- See the course calendar

  https://engineering.purdue.edu/ece362/about/calendar.pdf

- It shows:
  - lecture plan
  - lab experiment schedule
  - lab practical exam schedule
  - various university deadlines

Lab Experiments

- The lab for this course is located in room EE 069
- You must *consistently attend* the lab division for which you have officially registered
- Quizzes will be given at the *beginning* of each lab period.
- Pre-lab exercises that are assigned must be finished and submitted by the *beginning* of your scheduled lab
- Steps of experiments must be demonstrated to your lab instructor *as they are completed.*
- All work for a given lab must be completed and submitted *by the specified due date* to receive credit. (Maybe end of lab. Maybe later.)
- Make-ups require an *officially excused absence* and *pre-approval* by your Lab Instructor

Important Lab Rule

- If you bring *food, drink, or liquid* into EE 069 at any time, you will receive a zero score on a lab experiment.
- We're not going to argue or bargain with you about this.
  - It does not matter how strong or secure a bottle is.
  - It does not matter how small the amount of liquid is in a bottle.
  - There is a checkbox on the lab evaluation that will be marked.
- You <u>can</u> put these materials on the sink in the back of the room.

Lab 0 is this week

- We will have labs weekly, except for weeks where there is a lab practical exam.
- You will have a "real" lab experiment this week
  - It’s real enough that we decided to give it a grade
  - The lab is only about following (tedious) instructions to get your development board working with the software you will use
  - Take your own laptop computer to lab and get help with setting up development software

Open Lab / Office Hours

Scheduled office hours for all course staff members are posted on the course web site

We will also be using Piazza to facilitate on-line discussion

Lab Office Hours (Monday-Thursday, 7:00-10:00 PM) will start August 30

Homework

- Posted on the web site
- We'll try to put these out with reasonable regularity, but labs must take priority
- Watch for the due dates
- Your first assignment (homework 0) is to read the *Course Policies & Procedures* and *Lab Policies and Procedures* documents posted on the web site and take a student information survey.

Individual Projects?

- In any "normal" semester, we would have a team-based mini-project in ECE 362. We haven’t had projects for the last three semesters. Why?
  - It wasn’t a good idea for anyone to work closely with anyone else
  - Much of my time is occupied with making sure teams don’t do something injurious
- Instead, we had individual projects that gave students some meaningful design experience
  - This was one reason that the lab kit was updated – materials were added to allow a good experience for everyone

Let’s do some Mini-Projects!

- Embedded system design based on STM32F091, lab kit, and anything approved to add to it
- Basic requirement is to design a product that makes good use of the processor’s computational and interfacing resources
- Done in teams of 4 students (self-selected)
  - Unless you don’t team up, then it will be non-self-selected.
- Rick has lots of rules about what you can and cannot do.

Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated:

1. an ability to program a microcontroller to perform various tasks
2. an ability to interface a microcontroller to various devices
3. an ability to effectively use microcontroller peripherals
4. an ability to design and implement a microcontroller-based embedded system

Learning Outcome Assessment

- Outcome 1 will be assessed based on scores received for the lab practical programming problems, for which a *score of at least* 60% on either of the two practical exams -OR- an *average of at least* 60% on all lab experiments will be required to demonstrate basic competency
- Outcome 2 will be assessed based on the midterm lab practical concept exam, for which a *score of at least* 60% will be required to demonstrate basic competency -OR- an *average of at least 60%* on labs 1 – 5.
- Outcome 3 will be assessed based on the midterm lab practical concept exam, for which a *score of at least* 60% will be required to demonstrate basic competency -OR- an *average of at least 60%* on labs 6 – 10.
- Outcome 4 will be assessed based on the Embedded System Design Mini-Project, for which a *score of at least* 60% will be required to demonstrate basic competency

Grade Determination: RWP

- This course is not curved.
- Each assignment and exam has a weight. You'll earn a percent score for each one. For instance:
  - Homework: 1
  - Lab: 2
  - Exam: 22
- Your Raw Weighted Percent (RWP) will be determined by the sum of each score times its weight, and this sum will be divided by the total of weights.
- This course is not curved.

Grade Determination: NWP

- This course is not curved.
- We'll normalize the highest RWP in the class to 100% and use the multiplier for everyone. This is the Normalized Weighted Percent. (Note: Usually the highest RWP in the class is already close to or greater than 100%.)
- The NWP is used to determine your letter grade based on 90 / 80 / 70 / 60.
- This course is not curved.

Grade Determination

90% to 100%	A- / A / A+
80% to 90%	B- / B / B+
70% to 80%	C- / C / C+
60% to 70%	D- / D / D+
< 60%	F

Bonus Exercises (contingent on no zero scores on assignments)	Δ
Homework Assignments (10 @ 1)	10.0
Lab Experiments (11 @ 2)	22.0
Lab Quizzes (10 @ 0.5)	5.0
Lab Practical Concept Assessment Exams (2 @ 10)	20.0
Lab Practical Programming Assessment Exams (2 @ 12)	24.0
Embedded System Design Mini-Project (Outcome 4)	15.0
	96+Δ

Note: We may have more or fewer assignments depending on circumstances, but the weights for each assignment will not change.

Borderline Cases and Incompletes

- A “borderline” is officially defined as an NWP *within* 0.5% of a cutoff
- Before course grades are assigned, the instructor will carefully examine all such cases to determine if the next higher grade is warranted
- IMPORTANT NOTE: The “next higher grade” is NOT AUTOMATICALLY GUARANTEED!!
- A grade of I or E will be given only for cases in which there are *documented* medical or family emergencies that prevent a student from completing required course work by the end of the semester
- University Regulations stipulate that a student must be PASSING in order to *qualify* for a grade of I or E

This is a difficult and rewarding class

- The microcontroller we use has 1500 pages of documentation
  - You are expected to understand about half of it
  - The textbook is another ~700 pages
- Often, it takes several hours of reading to be able to write five lines of code you need to solve a lab or homework step
  - You might instinctively want to find a way to "speed that up"
  - If you do not take the time to find the answers on your own, you will be unprepared for the next five lines of code, the next homework, the next lab, and especially the next lab practical
    - Students regularly get zero scores on lab practicals

Academic Integrity

- For purposes of this class, we broadly define academic dishonesty as being any attempt by a student to improve a grade beyond his or her own *personal* understanding of the material in question.
- See the COURSE POLICIES AND PROCEDURES document for a longer discussion.
- You will be faced with choices. Call them moral dilemmas.
- Keep in mind we use computer software to find similarities between students' work. Inordinately similar work is an indication of a lack of personal understanding, and it has penalties...

Academic Dishonesty Penalties

- When the course staff find academic dishonesty, the minimum penalty is a zero on the assignment in question *and* a single letter drop for a final course grade.
- All cases of academic dishonesty will be reported to the ECE Associate Head for education, and Office of Student Rights and Responsibilities.
- Activities that are considered to be dishonesty are listed in the COURSE POLICIES AND PROCEDURES document.
- We expect that no student will work with any other student (past, present, or future) on work to be submitted for a grade.

Emergency Preparedness

- To report an emergency, call 911
- To obtain updates regarding an ongoing emergency, sign up for Purdue Alert text messages, or view current status at www.purdue.edu/ea
- There are nearly 300 Emergency Telephones outdoors across campus and in parking garages that connect directly to the PUPD − if you feel threatened or need help, push the button and you will be connected immediately
- If a fire alarm sounds during class we will immediately suspend class, evacuate the building, and proceed outdoors − do not use the elevator
- If we are notified during class of a Shelter in Place requirement for a tornado warning, we will suspend class and shelter as directed
- If we are notified during class of a Shelter in Place requirement for a hazardous materials release or a civil disturbance (including a shooting or other use of weapons), we will suspend class and shelter in the classroom, shutting/securing the door and turning off the lights
- See the Emergency Preparedness website for additional information http://www.purdue.edu/ehps/emergency_preparedness/index.html

Important Things To Do Today

- Piazza will be set up for you
- Make sure that you have your own lab development kit
- Make sure that you have a master lab kit
- Get a textbook if it would help you
- Make plans for obtaining a Digilent Analog Discovery 2
- Do homework 0 first
- Do lab 0 next
- Details are on the ECE 362 website: https://engineering.purdue.edu/ece362

Important Deadlines/Restrictions

- All lab division changes must be done through MyPurdue during the first week of classes
- You must attend the lab division for which you have officially registered
- No late pre-labs or homework will be accepted
- Requests for make-up labs must be approved by your Lab Instructor in advance of the evening office hour session you plan to complete the makeup
- Quizzes will be given at the beginning of your scheduled lab period – there will be no make-ups (quizzes missed due to officially approved absences will be pro-rated – maximum is 2)
- Makeup exams for planned absences on scheduled exam dates must be arranged in advance and completed during the week the exam is being administered

How to do well in this class

- Do the advance reading for each and every lecture, lab, and homework
  - Learn to anticipate and understand errors in documentation
- Practice the lecture examples by typing them in yourself
  - rather than copy/pasting them
- Start on assignments as soon as possible
- If you have questions or difficulties, talk to a teaching assistant or instructor
  - Sometimes, you will find that they give you incorrect advice
    - Everyone is learning here

Let’s Get Started!

- The first half of this course will cover assembly language programming and how to use it for microprocessor interfacing
- Gradually, we’ll move through the various kinds of peripherals available to us, interface external devices, and do more work in C than assembly language
- All of the material we will cover is going to be extremely useful in your future career. (I would not teach you useless things)
- At times, it will be difficult, but keep in mind the skills that you are developing and what you will be able to do with them
- I hope to make this one of the most enjoyable courses you will take