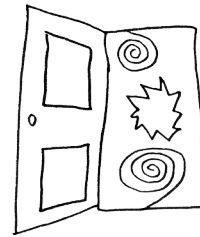


Syllabus: 60-223 Intro to Physical Computing

Carnegie Mellon University

Spring 2024



The physical computing
portal beckons!

Schedule

Mondays and Wednesdays, 10:00–11:50am, in IDeATe's Physical Computing Lab (Hunt A10)

Academic units: 10.

Staff

Professor: Robert “Zach” Zacharias (*he/him*), rzachari@andrew.cmu.edu

phone: 412 268 5973

office: Hunt A9A (across the hall from the Phys Comp Lab, the room with the wavy glass door)

lab hours:

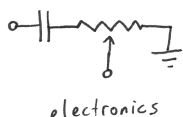
- Mondays and Wednesdays, noon–12:30pm in Hunt A9A
- and liberally by appointment (just email me with your request and I'll be happy to set up a time to talk)

Teaching Assistant: Chuyi “Angie” Wang (*she/her*), angelinaw@cmu.edu

Important links

- **Main course site:** <https://courses.ideate.cmu.edu/60-223> This site is updated frequently throughout the semester with assignment information.
- **Student documentation site:** <https://sites.google.com/andrew.cmu.edu/60-223-s24> Documentation for the three major projects is posted here.
- **Canvas page:** <https://canvas.cmu.edu/courses/39975> Some asynchronous learning modules are completed via Canvas; you'll submit homeworks there; and it's where grades are posted.
- **This syllabus** is available at <https://courses.ideate.cmu.edu/60-223/s2024/syllabus.pdf>

Course synopsis

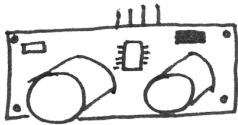


This practical project-based course begins by covering the basic technical skills (including electronics, programming, and hardware) needed to build interactive objects with embedded

behavior using the Arduino microcontroller. Inputs to read information about the world include sensors such as an ultrasonic ranger, thermometer, light sensor, and human inputs like buttons and knobs. Outputs to affect the world include actuators such as motors, LED lights, speakers, and haptic feedback devices.

```
if (x < 3) {
  digitalWrite(LED, HIGH);
}
```

programming



hardware

Individual and group projects challenge students to apply their technical skills in creative ways. Readings and guest speakers address topics pertaining to design for people with different abilities, as well as environmental effects of the electronics industry. The class will be working with a local group of people living with disabilities who serve as design clients for the final project; students create assistive devices of a practical or whimsical nature for their critique and feedback.

Prerequisites

There are no formal prerequisites or assumed topical knowledge for this class. However, some basic programming understanding (such as familiarity with variables and their use, the `if...else` structure, `for` and `while` iterators, etc.) will be helpful, as we spend little time in class on the rudiments of programming. In the past, students without any prior programming experience have been able to succeed by learning as they go, and asking for help as needed.

Major deliverables

There are a sequence of homeworks as well as three major projects in the course. See the particular assignments on the main course site for further details on each. Briefly:

- **Homework** (15% of final grade)

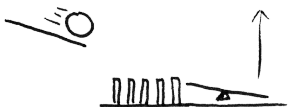
- *Asynchronous learning modules* are prerecorded video lectures that cover the bulk of the course's technical learning, addressing topics like circuit design and programming. These are accessed via the course Canvas site.
- *Technical homeworks* are opportunities to stretch your ability and understanding of the nuts and bolts of writing software and driving electronics.
- *Reading/watching homeworks* typically consist of journal articles or videos addressing issues pertinent to the course. There are only a handful of these assigned during the semester.
- *Weekly check-ins* are brief, weekly opportunities for you to ask any questions you've got and/or tell me about your experience in the course.



video lecture

- **Project 1: A Double Transducer** (15% of final grade) is a technical exercise in changing the form that

a physical input signal takes, changing it again, and then outputting another signal. Students are assigned to work in teams of two, but each student builds their own machine, learning some electronics fabrication along the way. These transduction



Double Transducer

machines are linked to each other so that (ideally) a single input signal can pass through the chain of the entire class's devices and produce a single physical output at the end. Last semester's student documentation for this project is [here](#).

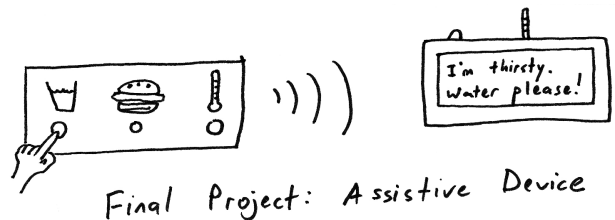
- **Project 2: An Assistive Device for Someone You Know Very Well** (25% of final grade) is an opportunity to build yourself something that may be useful to you in your own life. Students work on their own project. Last semester's student documentation for this project is [here](#). Prior works include:

- a variety of creative alarm clocks which, for instance, require a special procedure to silence,
- a long-term memory aid to keep precious memories intact by printing out a reminder before bedtime,
- a device to reward the owner for not using their phone during a timed interval,
- a reminder for a thrombosis patient not to remain sitting for too long,
- a bolted-on turn signal for a scooter, and
- a timed lock box to prevent the designer from eating chocolate too late at night.

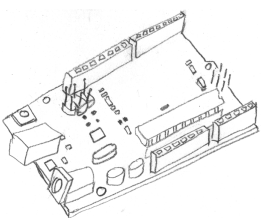


- **Final project: An Assistive Device for a Person Living with Disabilities** (45% of final grade) is the major effort of the second half of the semester. Students work in assigned groups of three to produce a novel interactive physical computing device custom tailored to the needs of a particular community member. Last semester's student documentation for this project is [here](#). Prior works include:

- a portable device to help a color blind user determine the color of any object/surface,
- a custom keyboard and mouse input to help a user more comfortably play computer games online,
- a device to automatically lower the volume of a television when loud commercials come on,
- an alarm clock with a braille interface for a deafblind user,
- a machine to make yarn balls of user-selected length, and
- a foot-controlled MIDI instrument for a wheelchair user to play songs.



Course materials



Enrolled students are supplied with a kit of electronics that is theirs to keep, and throughout the semester (as well as beyond), students are encouraged to take advantage of IDeATe's Physical Computing Lab equipment and resources. The Arduino Uno R3 is our primary microcontroller in the course. To program that hardware, we use the Arduino integrated development environment, which is

open-source and gratis software, available for download from <https://www.arduino.cc>. There are no required texts, and there is no course materials/lab fee.

Learning goals for this course

Some of our learning goals are:

- Demonstrate an appreciation for and ability to participate in critique of one's own work and the work of others
- Demonstrate an understanding of the role of reflection in learning and designing (begin to become a reflective practitioner)
- Demonstrate an ability to articulate the story (visually, verbally, etc.) of one's own work and one's own learning
- Demonstrate the ability to work in a multidisciplinary environment
- Demonstrate an understanding of the cultural context, and social and environmental implications of electronics in the modern world
- Demonstrate technical and creative skills in writing software in the Arduino IDE, creating circuits that safely work as intended, and making an effective, interesting, useful device to help improve the life of a person living with a disability

Schedule overview

This Gantt chart shows a week-by-week course overview:

			course week															
Course event or project	start	end	1	2	3	4	5	6	7	break	8	9	10	11	12	13	14	finals
Introductory homeworks	1	3	x	x	x													
Project 1 ideation	2	3		x	x													
Project 1 work	3	4			x	x												
Project 1 due	4	4				!												
Project 2 ideation	4	5				x	x											
Project 2 work	5	7					x	x	x									
Project 2 prototype due	6	6						!										
Project 2 due	7	7							!									
Final project interviews	8	8									!							
Final project ideation	8	9									x	x						
Final project prototype build	9	11										x	x	x				
Final project prototype crit	11	11												!				
Final project final build	11	14												x	x	x	x	
Final project final critique	14	14															!	
Final project documentation	finals	finals																!

Note that red exclamation points indicate due dates or singular events, while green x's indicate ranges during which work happens.

Professor's absence towards the end of the semester

I am very happy to report that we're expecting a brand new human being to join our family, most likely some time around late March or early April. Once the baby is born I will be stepping back from my teaching role in the class so as to have some focused family time, and one or more IDeATe colleagues will take over primary responsibility for the class through the end of the semester. I am hoping to not totally disappear, and come at least a few times to check in on everyone's progress and at the very least join for the final critique!



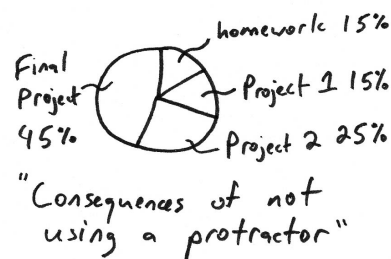
Course grading scheme

We are going to be using “specifications grading” (often abbreviated “specs grading”) in the course this semester. Specs grading may be new to you; in brief, it's a grading system that establishes very clear rubrics centering learning goals, with relatively few discrete grade steps. In general, any assignment or project will have a rubric, posted on Canvas, which describes how points will be awarded.

Most assignments will be able to be resubmitted for a regrading. The idea is that if you would like to improve your score, you are welcome to go back and do what's missing to achieve the higher grade you're seeking. Once an assignment grade is returned to you, that opens a seven-day window during which you can resubmit that assignment for regrading if you choose. It is important that you actually resubmit that assignment via Canvas in order to affirmatively communicate that you've made improvements and would like that work to be regraded.

The overall course grade is computed from these components:

- 15% homeworks
- 15% Project 1
- 25% Project 2
- 45% Final project



The final percentage is rounded to the nearest whole value and midterm/final letter grades are allocated using the following scale:

final percentage of points earned	undergraduate grade	graduate grade
≥ 97	A	A+

≥ 93 and < 97	A	A
≥ 90 and < 93	A	A-
≥ 87 and < 90	B	B+
≥ 83 and < 87	B	B
≥ 80 and < 83	B	B-
≥ 77 and < 80	C	C+
≥ 73 and < 77	C	C
≥ 70 and < 73	C	C-
≥ 67 and < 70	D	D+
≥ 60 and < 67	D	D
< 60	R	R

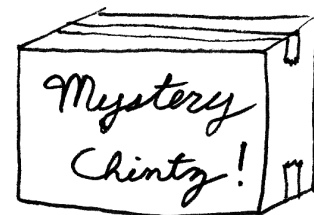
Class policies

Presence

Class time is quite precious—we've got only 27 class meetings in total, about 50 hours over the course of the semester. Because of this, there are some clear expectations for myself and for you:

- I will get to class early and ready to go. During class time, I'll focus exclusively on our course.
- I'll use class time as wisely as I can: e.g. if the whole group does not need to be involved in a discussion, I'll try to bring only the needed group together.
- In that same spirit, if I'm able to assign a pre-recorded lecture as homework, rather than taking class time to do that teaching, then I will aim to do that.
- You'll also use class time carefully: you will come on time and ready to learn.
- You'll use class time to focus on the class, and not the fun things happening inside your phone or out on the internet. (See next section for more on that.)

Students with a perfect attendance record at the end of the semester will get a charmingly chintzy award made by the instructor.

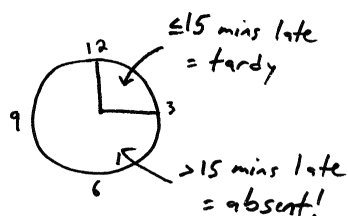


Absence

You are expected to attend class, and to arrive on time. Past experience has repeatedly shown that higher attendance correlates with greater success in the class, so it's in your best interest to come to class!

You are given two unexcused absences without penalty; beyond that, any additional unexcused absence will result in a 3 point deduction off of your final grade in the course. E.g.: at the end of the semester your final

average is 92.4% (which would earn an A), but you have three unexcused absences; your grade falls to 89.4%, which earns a B.



Late arrivals to class are disruptive to the group. Please arrive on time (or early). Tardiness of more than 15 minutes is counted as an absence.

If you expect you won't be able to attend a session for any reason, or if you'll be late, please email me as early as possible to request an excused absence. Excusable reasons for absence include religious, sport, or academic obligations;

explanations that won't warrant an excused absence include working on buggy/booth/etc., or your friend visiting from out of town.

If you're feeling ill, please email me advising of the circumstance as early as possible and focus on taking care of yourself. You will never be penalized for missing class for a health-related reason. Seek medical care as needed, and rest up so you can regain your health and return to full participation.



The outline of each class session is posted after the class on the [class log](#) page. If you want to know what you missed, please look there first, and then ask your classmates, or the instructor, questions.

Phone/computer use

While we're in class, please don't use your phone for non-class purposes. If you need to use your phone to contact others, just step out into the hallway. (If you're using your phone to look up information/resources/etc. for class, that's fine and there's no need to take special steps to remove yourself from the classroom.)

While we're in class, please don't use your computer for random internetting, social mediation, or any other use that isn't pertinent to class. You've got the whole rest of your life to TweetGram sweet memes and #tags (though I don't especially recommend it).

**I AM THE DESTROYER
OF ATTENTION!**



The use of distracting technology by students in the physical classroom is obviously deleterious to the student who's choosing to use it, but it's also harmful to other students *who are merely sitting near the distracted student*. A 2013 article in "Computers & Education" pretty much spells it out in the title: "Laptop multitasking hinders classroom

learning for both users and nearby peers.”¹ A 2015 survey of 675 college students in the U.S. found that they spent “an average of 20.9% of class time using a digital device for non-class purposes,”² which is pretty alarming. Please do your best to focus on class during class.

Accommodation

In the spirit of encouraging everyone to be maximally present in class together, it’s important that students feel comfortable and supported. If there is anything physically in the environment that can be reasonably adjusted to make your learning experience better, you should feel generally empowered to make that adjustment. If the lights are too bright at your table, please ask your neighbors if it’s ok to dim them, and if yes, go ahead and do so; if we’re playing music at a work session and it’s too loud, please say so; etc.

If there is any aspect of instruction that is giving you difficulty, such as my not spending long enough on a topic or making reference to a point we haven’t covered yet, please speak up. This sort of critique is very helpful to maintaining a successful classroom and much appreciated.

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

Statement on diversity

Heterogeneous teams are better than homogeneous ones at innovating.³ IDEATe is a heterogeneous environment by design, and our classroom is as well. Having students from a variety of academic backgrounds and college years is one way in which we aim to diversify the space; but also we also embrace diversity along other axes such as culture, national origin, race, gender, language, socioeconomic status, disability, and religious adherence. We sincerely believe that bringing together many different kinds of people makes for a richer learning environment for everybody.

If at any point you feel that you’re experiencing discomfort brought about by discrimination along any of these lines (or others), please immediately notify me so that I can take appropriate steps to rectify the circumstance.

¹ Sana, F., T. Weston, and N. J. Cepeda. “Laptop multitasking hinders classroom learning for both users and nearby peers”. *Computers & Education*, volume 62. 2013. pp. 24–31. <https://doi.org/10.1016/j.compedu.2012.10.003>

² McCoy, B. R., “Digital Distractions in the Classroom Phase II: Student Classroom Use of Digital Devices for Non-Class Related Purposes”. *Faculty Publications, College of Journalism & Mass Communications*, vol 90. 2016. pp. 5–32. <http://digitalcommons.unl.edu/journalismfacpub/90>

³ Prat, A. “Should a team be homogeneous?”. *European Economic Review*, volume 46. July 2002. pp. 1187–1207. <https://www.sciencedirect.com/science/article/pii/S0014292101001659>

I'm always happy to make time to speak with you individually about any concern you've got; I'm just an email away. If you would like to submit feedback or comments to me anonymously for any reason, please use [this form I've created for that purpose](#).

Additionally, there are two University-wide resources for reporting incidents of bias or discrimination:

- *The Center for Student Diversity and Inclusion*
 - email: csdi@andrew.cmu.edu
 - phone: (412) 268-2150
- *Confidential third-party ethics reporting service*
 - cmu.ethicspoint.com

Lab access and policies

Enrolled students have access to the IDeATe Physical Computing Lab whenever Hunt Library is open. Hunt library's hours are posted on [their website](#).

IDEATe spaces' schedules are [available here](#) (you'll have to log in to see them).

The [Phys Comp Lab's inventory](#) is online for your convenience. If you discover that we are running low, or are out of, any part or material in the lab, [please fill this form out](#) so it can be quickly replenished.

While in the Phys Comp Lab please observe some simple rules:

- Food and nonwater drinks may only be consumed in the *Zone of Shame* by the door; this is an electronic lab space, and it's important to sequester comestibles from our work environment for the protection of both.
- The exception to this rule is that covered water containers are permitted at work tables.
- Please store project material in your cubby; if you need more space let us know and we'll make arrangements.
- Tools that belong to the room (like those on the pegboard in the Heavy Work Zone, or in the red tool cabinet) must always remain in the room. Don't take them elsewhere without asking, and don't hide them in your cubby!
- Electronics in the drawers are available for your use; take them as you need. The expectation is that you'll return things when you're done with them.
 - Don't worry so much about returning little stuff like resistors and LEDs; do worry about things like motor drivers or rotary encoders or pumps.

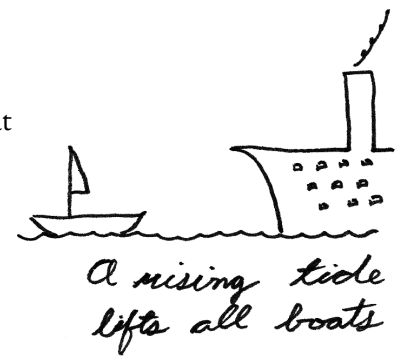


- Broken electronic components should be disposed of in the Electronic Waste Bin underneath the electronics bench; these contain toxic metals and need to enter a different waste stream than regular garbage.
- If you're reading this, please click [this](#) link.
- It's kind of a kindergarten situation: when you're done working, please clean up after yourself.

Projects and collaboration

As mentioned above, this and all IDEATe courses purposefully attract students from a wide disciplinary range, including art, design, engineering, architecture, computer science, business, science, and more.

Two of the three projects in the course are completed in groups rather than individually. The expectation is that group members will honestly strive to work together on their projects and will rise or fall as a unit, understanding that identifying complementary strengths and weaknesses early on will help the team succeed. All members of a group receive the same grade for a project except in unusual circumstances.



The final project includes a peer critique during the process, which is an opportunity to give feedback to the course staff about your group dynamics. That said: if your group is having trouble working together, please reach out to the instructor as soon as you think there may be some real issues. As an authoritative outsider, the professor can step in to help in ways that group members themselves can't.

Grading and due dates

Assignments are generally due at the beginning of class, and arriving late to class because you are finishing the assignment results in a late assignment mark (so you might as well come to class and finish the assignment later).

Homeworks and **project documentation** may be turned in late for grading and will be penalized 25% per 24-hour period of tardiness.

Projects are graded based on their state at the time they are due, i.e. the day of the in-class critique. They may not be handed in late, except in extreme circumstances. If you are worried about not being able to complete a project on time, contact the instructor as early on as possible. It is better to hand in or present *something* rather than nothing. If, for instance, you find right before class that your project is broken, or it's only partially complete, etc., then just show what you've got and you'll get partial credit. If you don't show anything, I'll have no basis for giving you any points!

Grading timeline

You can expect feedback on assignments within one week of handing them in. If you don't get a grade or other response from me within that timeline, please contact me right away to let me know. I might've overlooked your work accidentally, and I don't want you to be waiting unnecessarily long for feedback from me.



*Cookies will be used
to purchase your forgiveness.
You are forewarned.*

In order to help ensure that I get you your grades on time, I'll bring in snacks for the class on any day when I've owed grades for more than a week.

Academic integrity

You are not expected to write every line of your own code in this class. We gratefully stand on the shoulders of giants and also regular-sized heroes who share interesting projects on Instructables, or Github, or their blogs. You are *expected* to incorporate ideas, hardware/electronics designs, and even verbatim software fragments from other sources. This isn't considered plagiarism in this class if: 1) you properly cite sources, and 2) you don't simply make a wholesale reproduction of somebody else's project but instead use their work as a jumping-off point. If you do plagiarize, however, you can expect a serious response, detailed below.

If you're not sure if you're borrowing too much from somebody else, or you don't know how to credit the work you're borrowing from, please discuss it with the professor.

Homework and collaboration

Homeworks in the course are generally completed individually, though it's acceptable for students to work together on the technical homeworks at the beginning of the semester.

Students' homework code may be analyzed algorithmically to detect collaboration, and also examined and graded by the professor. All code submitted for project documentation should have an opening comment block as specified on the project assignment, where any collaboration with other students, or sources from the internet, printed media, or any other place, must be disclosed.

A failure to explicitly note any collaboration or code source in this comment block is considered plagiarism and carries a harsh penalty: the student will receive a -100% on that assignment (e.g. for a 10-point assignment the student receives a grade of negative 10 points). Additionally, the student's advisor will be informed of the infraction, and the University disciplinary structure may be invoked as well, at the instructor's option. **Please** don't copy code from any place or person without properly citing it. As always, if you have questions, ask!

Use of ChatGPT or other generative AI systems for coursework is generally prohibited, with two exceptions: it is permissible to use these to assist you in writing Arduino code for Project 2 and the Final Project. If you use

any generative AI system as a source in writing your code, it should be cited as you would any other. It is *not* permissible to use any generative AI system for writing any reflection, homework, or project documentation in this course, nor may you use any translation service (AI or not). With the exceptions of the option of using cited internet sources and/or generative AI for assisting in writing Arduino code in Project 2 and the Final Project, all of the words you submit in this course must be entirely your own, i.e. written solely by you.

Recording class

Please do not record class without obtaining prior written permission from the instructor. If you have special dispensation via the Office of Disability Resources to record as an accommodation, then naturally that is permissible.

IDeATe

IDeATe, the **I**ntegrative **D**esign, **A**rts, and **T**echnology network at Carnegie Mellon, offers undergraduate minors and courses in Game Design, Animation & Special Effects, Media Design, Sonic Arts, Design for Learning, Innovation & Entrepreneurship, Intelligent Environments, Soft Technologies, Physical Computing, and Immersive Technologies in Arts & Culture. These areas merge technology and creativity and provide learning opportunities for interdisciplinary collaboration. IDeATe minors and courses are open to all majors. We welcome students from every discipline to the unique learning environment that exists at Carnegie Mellon.

IDeATe is not its own department. Rather, Carnegie Mellon's departments contribute faculty and courses to the IDeATe curriculum. Therefore, IDeATe does not have its own course number prefix. You can find the IDeATe course offerings for the upcoming semester by going to the "IDeATe Courses" section of <https://ideate.cmu.edu/>.

Relevant IDeATe skill-building micro courses

IDeATe offers a selection of "micro" courses; these are skill-building workshop-style classes which meet only a few times and confer 1 academic credit. Here are some micro courses relevant to Physical Computing:

- **99-353 IDeATe CAD and Laser Cutting** (super useful for fabrication!)
- **99-359 IDeATe 3D Modeling and 3D Printing** (also very useful for fabrication and design)
- **99-352 IDeATe Soft Fabrication Skills** (opening a whole new world of textile possibilities)
- **99-357 IDeATe Pragmatic Photography** (a broadly portable skill to have in your bag)
- **99-360 IDeATe E-Textiles** (integrating electronics and fabrics. Very neat!)

IDeATe resources

IDeATe Open Fabrication Hours

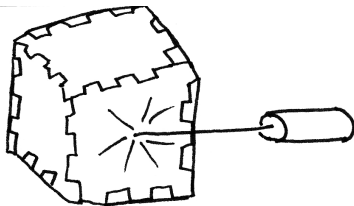
IDeATe offers Open Fabrication Hours Monday–Friday, 5–6 p.m. for the duration of the regular academic year. During this time, you can get individual help from IDeATe student staff in using the laser cutters, 3D printers, and other IDeATe facilities. This resource is available to all university affiliates. See <https://resources.ideate.cmu.edu/open/> for further details.

IDeATe Lending

Once you are enrolled in an IDeATe course, you will have access to IDeATe Lending, and you will maintain your access through the rest of your time at Carnegie Mellon. Please visit <https://resources.ideate.cmu.edu/lending/> for more detailed information on available resources, to review the IDeATe Lending Borrower Policy, and to find hours of operation.

As a student in this class, during the semester you will be able to charge the purchase of certain consumable materials available at IDeATe Lending to the course budget. Details of this will be discussed in class.

Laser cutter and 3D printer access



Using lasers to cut
wood boxes from a
website on the internet?!
What a world

IDeATe maintains three Rabbit laser cutters in the digital fabrication alcove off of room A5, and these tools are very precise, very fast, and very useful for all sorts of fabrication. Please read the latest laser access policy information here: <https://ideate.cmu.edu/resources/guides/laser-cutters/index.html>.

Note that there are certain safety trainings required⁴ before you'll be able to use the lasers; see that policy page for details. Schedule permitting, we will run a laser safety and use tutorial during class time which can serve as part—but not all—of the credentialing necessary to access the IDeATe laser cutters.

IDeATe runs 3D printing machines also in the alcove off of room A5. To submit a print job to our Mosaic printer queue, go to <https://array.ideate.cmu.edu/> and upload your STL file. For further information about 3D printing with IDeATe, including the other printers available, get in touch with Cody Soska (csoska@andrew.cmu.edu), IDeATe's Technical Specialist who manages all of that equipment. His desk is in the main IDeATe administrative offices, in Hunt A9.

IDeATe advising

⁴ If you think you may want to get certified to use the lasercutters (and I recommend it), it's a good idea to sign up early for a fire safety training through BioRAFT, since they're offered on a limited basis: <https://cmu.bioraft.com/node/284572/sessions>

If you have questions or need advice about IDeATe minors or courses, please get in touch with Kelly Delaney, the Associate Dean for IDeATe. Her office is in Hunt A5A (right outside the double doors to A5, the digital fabrication space), and her email is kellydel@andrew.cmu.edu

Taking care of yourself

I look forward to hearing from you in your weekly check-ins so I can get a sense of your progress and wellbeing, but **I also ask that you reach out to contact me if there's anything that you think that I should know about your circumstances which can help inform my teaching and expectations. I'm always happy to make time to speak privately with students about any concerns.**

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. Be sure to take breaks if you've got large blocks of screen time. Get some fresh air. There's a big beautiful park literally across the street from Hunt Library. Go take a walk some time! Maintaining healthy habits will help you achieve your goals and cope with stress.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 or visit <https://www.cmu.edu/counseling>. The Student Academic Success Center is also a great new resource—visit them at <https://www.cmu.edu/student-success>. Consider reaching out to a friend, faculty member (I really am always happy to talk), or family member you trust for help getting connected to the support that can help.

Coda

Thank you for reading this lengthy syllabus. I've tried to be thorough in my discussion of the class so that you have a good sense of what to expect and have clarity around what I expect, as well. All of the structure provided by the rules and grades and submission requirements above is there partly because we're operating in an academic environment that requires that I evaluate you as fairly as I can with a grade at the end of the semester, and partly because a bit of structure helps provide us an environment in which we can thrive. Ultimately, though, my goal is to help you have a successful semester, and I ask you, again, to please reach out and write me an email if you've got any concerns I can help with.

I hope you're taking this class because you're interested in learning something new and useful. I'm teaching it because I sincerely believe that the ability and confidence to use these technological tools can be transformative for individuals—and that it's good to work towards a world in which as many people as possible are

empowered to solve meaningful problems in creative ways, build interesting things, and help enrich our shared experience through the act of helping others. I'm looking forward to learning with you this semester.