University of Colorado Boulder
College of Engineering & Applied Science, Integrated Design Engineering
GEEN 1400-030/031: Engineering Projects
Semester Year
Last Revised: April 10, 2026

Instructor:	Lily Cothren (she/her)	Electrical Engineering lico4769@colorado.edu
Office Hours:	TBD	
Course Assistants:	TBD email for TBD Office Hours: TBD time, TBD location TBD email for TBD Office Hours: TBD time, TBD location	
Meeting Times:	Lecture: Laboratory: **All classes meet in [location TBD]**	TBD time TBD time

Course Website
Grades and assignments will be posted to Canvas. canvas.colorado.edu

Course Communication
We will be using Microsoft Teams as our main source of communication outside of the classroom. You will receive an invite to your colorado email shortly after the class starts. Email your instructor if you cannot access the Teams chat. The instructors and CAs reserve the right to **reply to Teams messages only during business hours** (i.e., Monday through Friday, 8:00am - 5:00pm). The instructors will respond as quickly as possible, and you can typically expect a reply to emails within 1-2 business days.

While Teams is the preferred communication, you may wish to email the teaching staff. The following policies apply to all email communications with the professor and CAs:

- All emails must be written in a professional manner, including an appropriate subject line (that includes "GEEN1400:" at the beginning). Appropriate email etiquette is **expected**, consider following these suggestions: https://articles.outlier.org/email-etiquette-students. Inappropriate emails may be ignored by the instructor.
- The instructors and CAs reserve the right to **reply to emails only during business hours** (i.e., Monday through Friday, 8:00am - 5:00pm). You can expect a reply to emails within 1-2 business days.

Course Description
The purpose of this course is to provide you with an introduction to engineering through a series of projects done in interdisciplinary teams. You will learn in a hands-on way valuable engineering skills including communication skills, how to function in teams, and a variety of prototyping tools as appropriate to your projects, such as programming microcontrollers, dynamic modeling software, or computer-aided design (CAD).

Course Objectives

Specific learning objectives for the course include:

1. **Open-ended Hands-on Design Experience:** apply iterative design process to improve design; define functional requirements and specifications; generate alternative design concepts; work within constraints including safety; and appreciate and practice engineering habits of mind (see below).

2. **Teamwork Skills:** learn and practice effective teamwork skills; learn how to rely on other team members to give and receive help; demonstrate increased understanding of diversity, equity, and inclusion; and practice conflict resolution.

3. **Communication Skills:** develop a professional relationship with an engineering faculty member; develop technical writing and oral presentation skills; effectively communicate final designs to a range of audiences; and learn and practice active listening skills.

4. **Engineering Methodology:** build hands-on engineering skills for prototyping and manufacturing; practice the role of analysis in the design process; solve engineering problems with appropriate tools; and effectively apply technical skills to produce prototypes/design artifacts that consider a range of economic, environmental, and societal contexts.

5. **Engineering Ethics:** understand the importance of an ethical code for the practice of engineering; appreciate that difficult, 'gray' situations arise in engineering practice; and develop an ethical process that will yield appropriate decisions when needed.

Engineering Habits of Mind

Systems-thinking	Seeing whole systems and parts, and how they connect – recognizing interdependencies, and synthesizing. Equipping people to recognize essential interconnections in the technological world and to appreciate that systems may have unexpected effects that cannot be predicted from the behavior of individual subsystems.
Creativity and Creative Problem Solving	Inherent in the engineering design process; applying techniques from other traditions, generating ideas and solutions with others, providing generous but rigorous critiquing, and participating in engineering as a "team sport".
Problem-finding, selecting and defining	Demonstrating a desire to solve real problems through clarifying needs, checking existing solutions, investigating contexts, and quantifying and verifying specifications
Visualizing	Moving from abstract to concrete, manipulating materials, practicing mental rehearsal of physical space and of practical design solutions.
Improving	Relentlessly trying to make things better by brainstorming, experimenting, designing, sketching, guessing, conjecturing, thoughtful experimenting, and prototyping.
Adapting	Testing, analyzing, reflecting, rethinking, changing (physically and mentally).
Considering Ethics	Drawing attention to the impacts of engineering on people and the environment. Ethical considerations include unintended consequences of a technology, the potential disproportionate advantages or disadvantages of a technology for certain groups or individuals, and other issues, including equity in access to engineered solutions.
Demonstrating Optimism	Having a world view in which possibilities and opportunities can be found in every challenge and an understanding that every technology can be improved.
Productively Respond to Failure	Living the adage that "experience is what you get when you don't get what you want," proactively learning and applying the knowledge and perspective gained from each design iteration to inform the next design.
Collaborating	Leveraging the perspectives, knowledge and capabilities of team member when addressing design challenges.
Communicating	Essential to effective collaboration, to understanding the wants and needs of customers, and to explaining and justifying the final design solution within myriad constraints.

Class Engagement and Community Agreements

Our classroom is a place for us to grow as scientists and engineers. Oftentimes, we are so focused on learning the technical material that we forget how important it is to become effective scientific communicators. *Arguably, it is just as important to effectively communicate our work as it is to produce the work itself.* Without the ability to appropriately convey our scientific ideas, our ideas can get lost (since incomprehensible results can lead to little or no interest), or—perhaps even worse—misconstrued by someone else who misunderstood what you meant. As scientists, we are responsible for communicating our results with others because we understand them best.

Accordingly, this classroom will not only serve as a place where we learn technical material, but it will also be a place where we practice effective communication, including learning how to share our ideas and how to engage in new topics. In order to cultivate a space conducive to developing our communication skills, we will implement the following community agreements that will guide how we interact with one another throughout this course.

Be Curious and Listen Well

Strong scientists are not only open to hearing other ideas and perspectives, but actively listen to seek understanding and to learn more. We will always strive to maintain a spirit of science in our discussions, which means that we will do our best to keep biases at bay while learning something new. Curiosity can look like asking clarifying questions, or—when appropriate—comparing the new information against our own experiences and understanding.
A few examples include:

- "Just to confirm... Did I understand that correctly?"
- "That sounds very interesting, is that related to...?"
- "If I understood correctly, does this mean...?"

Be Comfortable with Mistakes and Fumbles

The beauty of our field is that it is ever changing as new contributions are made every day! This also means that *we will never know everything, and we will make mistakes.* When we make mistakes, we remain humble, kind, and learn what we can do better in the future. Further, we understand that they are never from a place of malice—we are all doing the best we can, so give yourself (or another) some grace. Part of being a scientist is failing and learning how to come back from it.
For this, try:

- "I tried... method initially. Can you help me see where I went wrong?"
- "I'm a little overwhelmed, so I think I need to just sit with this for a little bit. I'll come back when I'm ready."

As we learn how to communicate our work, we may not know what to say or how we want to say it. In this class, we embrace the fact that we may fumble our words.
In this situation, try:

- "I am trying to put together my thoughts..."

- "I am not quite sure how to say this, and I am going to try. Please correct me if I am wrong..."
- "I am a little nervous about sharing this, so please fumble with me as I try to put my thoughts into words..."

In response, we will offer support, ask for clarification, share stories, and more. We all understand that we will make mistakes and fumble our words as we learn the course material and practice communicating with one another.

Be Respectful Towards One Another

Pleasant collaborators are scientists who know when to share and when to listen. We always treat each other with respect and kindness. We invite and allow people to complete their thoughts before responding, and we engage with each other and disagreement through respect and empathy. It is our expectation that each of you will always be respectful to your fellow classmates and instructors. In an effort to create and maintain a professional atmosphere within the classroom, it is requested that you:

- Arrive to class on time and remain for the whole class, or if you must leave early do so without disrupting others
- Silence/Turn off your cell phone and put it away
- Put away all laptops and electronics (off the tables) during lectures and team presentations[1]
- Headphones are not allowed in class
- Refrain from having disruptive conversations during class
- Display professional courtesy and respect in all interactions related to this class
- *For example:*
  - "I am sorry I cut you off. Please continue."
  - "I appreciate you sharing with us. I don't necessarily agree with you as I think that..."

Further, *there is no room for harmful language here.* We use inclusive language as a way to respect our identities and challenge the harm that stereotypes and derogatory language (e.g., racist, sexist, homophobic, transphobic, xenophobic, Islamophobic, anti-Muslim, anti-Semitic, ableist, ageist, casteist, offensive language/actions, etc.) may cause others. When you have said, witnessed or done something rooted in discrimination or harm, speak up. Sometimes people are not self-aware based on their own experiences and the class is a place for us to collectively work together to grow as a supportive environment.

Say:

[1] Sometimes electronics will be used in class — your instructor will tell you when it's okay to use them.

- "Can we take a pause? I am not sure where you heard that, and I don't know if you are aware that what you said is... Let me explain how it landed on me."
- "I appreciate your insight as I think you are naming an important experience. Yet what you said could be harmful because..."

Support our Community

Understand that we are constantly learning from others. It is our responsibility to acknowledge our learning experiences and where they came from. Basically, give credit where credit is due!

Some examples include:

- "Thank you for sharing."
- "I never thought of it that way before, that helped me with my problem!"
- "I appreciate you explaining that to me. I will make sure I correct that in the future."

Like any professional environment, you can anticipate some variation in expectations based on the culture of your workplace, the personalities of the meeting participants, and the size and subject of the meeting. We have set expectations for the large class meetings here, but your project team will likely develop their own style and expectations for your own meetings. Be sure that the whole group understands and is comfortable with the expectations for conduct. When in doubt, always err on the side of being professional!

That being said, the best thing about a community agreement is that this is an agreement among its community members, so *these agreements are amendable*! If you have any concerns or would like to suggest any further agreements that would benefit the class, please reach out to me via email. I am more than happy to discuss any new proposals.

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation, or political philosophy.

For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance website.

Special Thanks! (an example of supporting our community) Thank you to Kelsea Souders for providing a template for this syllabus. Thank you for the conversations and collaboration with Dr. Kachine Kulick and Dusty Martinez, who also provided materials and templates for this community agreement. Thank you to Dr. Samuel Ramsey for the inspiring seminar on why scientists must be strong communicators. Finally, thank you to Dr. Donna Mejia for "fumble forward."

Required Course Activities

Skill-Building Workshops
During the first few weeks of the course, you will complete **five** skill-building workshops facilitated by the ITLL. Three of these will be held during class time (please check Canvas for specific dates) and two must be completed outside of class (on your own time) by the deadline posted on Canvas.
The three offered in class will be:

1. CAD Level 1
2. Electronics Level 1
3. Arduino Level 1

Outside of class you will need to complete the following:

1. Manufacturing Level 1: Saws & Drills Sign-up Link
2. Prototyping: Choose one from the following:
   (a) Operating the Laser Machines Sign-up Link
   (b) Operating the 3D printers[2] Sign-up Link

Important information regarding skill-building workshops:

- Students must **bring their BuffOne cards** to each workshop (this is scanned at the end of the workshop to show completion).
- **All students are responsible for signing up** for outside-of-class workshops on the ITLP Workshop Site: `https://itlp.colorado.edu/teaching-and-learning/skill-building-workshops/`
- **Extra Credit** is available if any student completes *both* prototyping workshops by the deadlines posted on Canvas.
- **If you miss an in-class workshop**, you must sign up on the ITLL Workshop Site to take the missed workshop outside of class, on your own time. Once completed, email the CAs with proof of completion.
- There are **two ways** to gather proof of workshop completion (submit either screenshot to Canvas):
  1. Go to the ITLP's "Past Workshops" page and log in with your CU Identikey. Take a screenshot of your completed workshops.
  2. Use the ITLL Kiosk located in the hallway by swiping your BuffOne Card: Follow these instructions.

[2] By completing this training, you recieve $10 in free 3D printing credit from the ITLL

Individual Homework Assignments
There will be a small number of individual homework assignments assigned for this course. The specific details and due dates will be posted on Canvas, but they will be used to help establish preliminary knowledge and skills that will help you during the projects.

Team Projects
This is a project-based course. During the second week, you will be placed on a team of 5-6 students: This will be your team for the entire semester. The semester is divded into two projects: (1) Introductory Project and (2) Final Project.

(1) Introductory Project: Weeks 1-4
Your team will be tasked to use your creativity and problem-solving skills to achieve a specific set of requirements (full instructions and requirements will be posted to Canvas). Your project will expose your team to the following skills and resources in the ITLL: 3D printing, machining, laser cutting, electronics, and Arduino programming. This project includes the following key deliverables (see Canvas for deadlines):

1. Team Plan: Teams will submit a document that outlines their team's plan for weekly meetings (outside of class), communication plan, code of conduct, and selected Team Name.
2. Project & In-Class Presentation: Teams will bring their final projects to class and give a 5-minute presentation describing their design process, including how they met the requirements.
3. Introductory Project Technical Report: Following specified guidelines provided by the instructor, teams will submit a report that describes their project and design process.

(2) Final Project: Weeks 5-the end
Most of the course is focused on your team's final project. Teams will work together to identify a relevant problem, research and scope that problem, develop engineering requirements, develop design solutions to meet your requirements, create multiple types of prototypes, test their solutions, and communicate their progress regularly throughout the course. The following are key milestones (see Canvas for the specific dates):

- Preliminary Design Review (PDR): Teams will present their problem-scoping process, requirements, initial brainstorming, selected idea, and initial prototype.
- Critical Design Review (CDR): Teams will present their final design concept, including progress on their final prototype and remaining manufacturing plan.
- Final Prototype & Presentation: Teams will present their final, completed prototype and testing results, along with their expo poster.
- Design Expo: A Design Expo will be held on **date TBD at the location TBD**, allowing you an opportunity to showcase your functioning prototype to the public. External judges will evaulate each project and provide written feedback. Your team will also prepare a poster to display alongside your final prototype. **Your attendance at this event is mandatory.**

Throughout the Final Project, your team will submit **technical reports** that communicate your design and progress (see Canvas for specific deadlines and instructions). Each deliverable builds on the previous, and you will be graded on how you improve and iterate the report throughout the semester.

- Deliverable 1: Problem formulation, design requirements, and team growth plan
- Deliverable 2: Updated deliverable 1 + Initial brainstorming, idea selection, and design alternatives.
- Deliverable 3: Updated deliverables 1-2 + inclusive design analysis, risk analysis, engineering analysis, and design iterations.
- Deliverable 4: Updated deliverables 1-3 + testing plan and results, manufacturing plan, bill of materials, final design description, and stakeholder feedback.

Design Notebook Requirement
Each student is required to maintain their own dedicated composition notebook for this course. This notebook should only be used for GEEN1400. The notebook will be used to document your design process, complete in-class activities, and track your progress throughout the semester. At the end of the term, you will submit your notebook for review. Grading will be based on completion and participation, not on the "quality" of the ideas, and will fall into the "Participation and Professionalism" grading requirement. Please bring your notebook to every class session, including labs. Requirements for the notebook:

- **Dimensions**: 7.5 inches wide by 9.75 inches high
- **Page Count**: Anywhere in the following range: 80-120 pages
- **Binding**: Bound with stitching along the spine, allowing the notebook to lay flat.
- **Ruling**: No requirements, can be any of: college-ruled, wide-ruled, blank, engineering, or grid.
- **Color or Brand**: No requirements or restrictions.

Links to some example notebooks:

- Staples 1-Subject Composition Notebook
- Amazon Mead Composition Notebook

Yes, you may decorate the cover with stickers and drawings, if you wish. Just keep it appropriate for a classroom.

Textbook
The course textbook, "Introductory Engineering Design: A Projects-Based Approach," is optional. It is available free online at the following link: https://www.colorado.edu/program/ide/academics/resources/introductory-engineering-design-textbook

Course Supplies and Project Budget

This projects course requires students working in teams to develop a multi-week design project that includes materials and fabrication of components specific to the project, as well as may require additional skills workshops after class hours through the ITLP or Idea Forge. The budget for your main design project will be created with funds from you and your design team. Each team member is expected to contribute up to $75 to fund any needed skills workshops and the main design project. Please factor in the cost of your expo poster, which will be ∼$30 per team.

Grading

The course grade will be based on a combination of group work and individual accomplishments:

- **Group Work:** 50%
  - Introductory project deliverables and report: 15%
  - Final Design Project deliverables, presentation, and report: 25%
  - Final Design Expo: 10%
- **Individual Accomplishments:** 50%
  - Safety, Saws, and Drills/Workshops Mastery 10%
  - Individual assignments/reflections/individual growth plan 10%
  - Peer evaluations 10%
  - Attendance 10%
  - Participation and Professionalism 10%

I reserve the right to adjust this scale if we spend more or less time on something during the semester. All group work grades are subject to change based on participation and the discretion of the professor. Course grades are assigned using the grading scale shown below. I am responsible for assessing student learning in this course; therefore, I reserve the right to adjust letter grades at the end of the semester.

Grading Scale

A	A-	B+	B	B-	C+	C	C-
> 93	$90 - 93$	$87 - 90$	$83 - 87$	$80 - 83$	$77 - 80$	$73 - 77$	$70 - 73$

D+	D	D-	F
$67 - 70$	$63 - 67$	$60 - 63$	< 60

Late Work Policy

Excused Late Work: Life happens! If you are unable to complete an assignment by the due date, you may request an extension by emailing the professor (cc the CAs). You must

request the extension **BEFORE the deadline**. However, if you miss a deadline due to unexpected extenuating circumstances, let the professor and CAs know after the fact to request an exception.

Unexcused Late Work: 10% will be deducted from assignments up to three days late, then 25% off for work submitted up to a week late. Work will not be accepted more than one week late (measured from the original due date, i.e., an assignment due on 9/10 at 11:59pm will only be accepted until 9/17 at 11:59pm).

Grade Disputes
If you disagree with any graded item, please email me a PDF of the graded item, as well as a description of why you believe your question was incorrectly graded within one week of the date I return the graded assignment.

Attendance Policy

This class simulates working in a professional environment. **Your presence in the classroom is required** just as you are required to show up to work when an employee.

Your team will be relying on you. That said, please do not come to class if you are ill or weather conditions make it unsafe for you to get to campus (e.g., snowstorm). If you must miss class for any reason (not feeling well, snowstorm, etc.), it will be excused *if* you message me before class time. If you cannot message me before class due to extreme circumstances, please message me as soon as you are able. Be sure also to clearly communicate absences with your team.

The semester will begin with every student being given full credit for participation/ attendance. Every student is allowed ONE absence/personal day without penalty. **Up to 1% of your final grade will be deducted for each unexcused absence after the first absence.** Students tardy to class 3 or more times may also be counted as absent. If you're running late, send me a message before class time.

We welcome undocumented students in this course and any immigration-related absences can be accommodated.

Building Policies

Building Policies

The First Year Projects classrooms serve all sections of GEEN 1400. They are excellent facilities and you are expected to maintain them in excellent condition. This means it is YOUR responsibility to ensure that the classroom and your work area in particular are cleaner than when you arrived.

Paint Policy: You should never paint inside the ITLL or on the patios, decks or sidewalks surrounding the ITLL. Place a painting tarp (from the south patio on the 2B basement-level) on a grassy area and paint well away from any permanent structures. Unused paint should be stored in the under-counter cabinet nearest to the entrance of the Manufacturing Center.

Artificial Intelligence Policy The use of generative AI (ChatGPT, Dall-E 2, Copilot) is not allowed on any assignment in this course. All ideas presented must be reflective of your own thought process and creativity. Use of AI will be treated as a form of academic dishonesty akin to plagiarism or cheating.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: honor@colorado.edu, 303-492-5550. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at dsinfo@colorado.edu or 303-492-8671 for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

If you have a required medical isolation for which you require adjustment, please email or message the instructor on Teams.

Religious Accommodations
Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, please email or message the instructor on Teams.

See the campus policy regarding religious observances for full details.

Preferred Student Names and Pronouns
CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation
CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.

Please know that faculty and graduate instructors must inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support for a variety of concerns, visit the Don't Ignore It page.

Mental Health and Wellness
The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.