Instructor: Bernard Amadei
Civil, Environmental, Architectural Eng.
ECOT 546
303-929-8167
amadei@colorado.edu

Office Hours: Wednesdays: 10 am-12 pm and 2-4 pm

TAs: TA1 email: TA2 email:

Meeting Times: Lectures: Monday 9-10 a.m
Laboratories: Tu and Th 9-11 a.m.
All classes meet in room ITLL 160,
accessible after hours by your Buff OneCard

"Engineering design is the process of devising a system, component or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation. " (ABET definition of design).

Course Description:
The purpose of this course is to provide you 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 computer tools as appropriate to your projects, such as programming microcontrollers, dynamic modeling software, or computer-aided design (CAD). 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; and work within constraints
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; and practice conflict resolution.
3) Communication Skills: develop a professional relationship with an engineering faculty member; develop technical writing and oral presentation skills; make an effective poster to summarize project; and learn and practice active listening skills.
4) Engineering Methodology: understand the role of analysis in the design process; solve engineering problems with appropriate tools; and effectively apply technical skills to produce prototypes and design artifacts.
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.
The theme of section 080 is appropriate technology and its use in solving human development issues (e.g., water, sanitation, energy, food, transportation, communication, health, etc.) in developing communities.

**Course web site:**

**Project Budget:**
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 the main design project. This cost is in lieu of a course text book, which could easily be twice as expensive. Please factor in a printed poster into your team budget, which will cost about $60.

**Grading:**
The course grade will be based on a combination of group work and individual accomplishment:

**Group work:**
- Introductory project presentation and report
- Design project presentations and report

**Individual accomplishments:**
- Oral presentation participation
- Design journals
- Individual writing assignments
- Attendance and participation
- Peer evaluations
- Spatial Visualization Mastery

**Spatial Visualization:** Successful completion of a standardized spatial visualization test (PSVR) is required. Students who do not pass the pretest will be encouraged to participate in spatial visualization skill-building workshops before attempting the test again. Faculty and TA support will be available to improve spatial visualization skills. Students may take the test multiple times until a passing score is achieved. Successful completion of the test earns a student full points for 5% of the final course grade. Students who do not successfully complete the test receive zero points for 5% of the course grade.

**Miscellaneous:**
- The textbook for this course, “Introductory Engineering Design: A Projects-Based Approach,” is optional. However, it is available for purchase for $20. To purchase the book, stop by the ITLL administrative office (ITLL 1B40). Available on-line at:
  http://itll.colorado.edu/index.php/courses_workshops/geen_1400/resources/textbook/
Students are expected to purchase their own **blank lab notebook** to use as a journal to record their class and project activities.

- In addition, each student will be **expected to pay up to a total of $75 towards supplies and expenses** for the projects.
- Each team will be provided a **toolbox** containing many useful small hand tools, and a **lock** for your assigned locker in 150/160. You will need to return the toolbox with all the original tools at the end of the semester. Missing tools must be replaced in order to receive your final course grade for all team members. For details of the toolbox policy see: [http://itll.colorado.edu/index.php/courses_workshops/geen_1400/resources/toolboxes_and_locks/](http://itll.colorado.edu/index.php/courses_workshops/geen_1400/resources/toolboxes_and_locks/)

- 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. It does not matter whether you made the mess, you should clean it up and take pride in your workspace. Please do not use the classroom tables for cutting, gluing, soldering, etc. Use the lab benches at the back for all such activities. Sharing workrooms also means that you do **not** have access to your lockers at all times. When other classes are in session, you may **not** enter to retrieve anything from your lockers. A full class schedule is posted on the classroom doors. If a group is found interrupting other classes, their grade will be adversely affected.

- You should **never** paint inside the ITLL or on the patios, decks or sidewalks surrounding the ITLL. Place a painting tarp (from the basement-level south patio) on a grassy area and paint well away from any permanent structures.
COURSE ELEMENTS

Introductory Project: Design, Construction and Testing of a Solar Cooking Oven

Team Dynamics Exercises are fun, moderately physical activities and problem-solving games in which we work together to solve a variety of interesting challenges.

Main Design Projects:
The main emphasis of the various design projects will be on appropriate technology and its use in solving water, sanitation, energy and health problems in developing countries. Appropriate technology is characterized as being small scale, energy efficient, environmentally sound, labor-intensive and controlled by the local community. It must be simple enough to be maintained by the people using it. It must match the user and the need in complexity and scale. It is designed to foster self-reliance, cooperation and responsibility, must benefit most people, and provide goods, services and jobs.

The course will give you an understanding of some of the most common and important technologies being introduced in small-scale community developments. You will be asked to create, design and construct small appropriate technological systems, processes and devices for a variety of settings associated with the developing world. Of equal importance, special emphasis will be placed on the societal impact and implications of appropriate technological systems.

A Design Expo will be held on Saturday, December 9th, 2017, allowing you an opportunity to showcase your functioning prototype to the public. External judges will evaluate each project and provide written feedback. Your attendance at this event is mandatory.

Guest Lectures throughout the course will be presented by faculty members and outside guest speakers from a sampling of engineering departments and industry. They will describe to you a research and/or design project they are working on to give you a flavor of the various engineering disciplines.

Several workshops throughout the semester will introduce you to some of the hands-on skills you will need to work on your projects, such as CAD, basic electrical circuits and safety and use of tools.

Some resources that may be helpful in your projects:

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<tr>
<th>What</th>
<th>Who</th>
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<tbody>
<tr>
<td>Manufacturing Center</td>
<td>Mark Eaton and Cameron Micksch</td>
<td>ITLL 2B50</td>
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<tr>
<td>General machine tools</td>
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<td>303.492.6605</td>
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<td><a href="mailto:mark.eaton@colorado.edu">mark.eaton@colorado.edu</a></td>
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<tr>
<td>Checkout and Proto Shack</td>
<td>Kai Amey</td>
<td>ITLL 2B14</td>
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<td>– ITLL 2B07</td>
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<td>303.735.0133</td>
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### Writing Resources

Written communication is an important skill for all engineers, and will be emphasized in this course in various ways, including individual writing assignments and team reports. There are resources available to help you with your writing skills:

- The Writing Center, located in Norlin Library, offers free assistance:
  [http://www.colorado.edu/pwr/writingcenter.html](http://www.colorado.edu/pwr/writingcenter.html)

### Classroom Behavior:

It is our expectation that each of you will be respectful to your fellow classmates and instructors at all times. In an effort to create a professional atmosphere within the classroom, it is requested that you:

- Arrive to class on time
- Turn off your cell phone
- Limit use of your laptop computer to class purposes (very rare!)
- Put away tablets, newspapers and magazines
- Refrain from having disruptive conversations during class
- Remain for the whole class, or if you must leave early do so without disrupting others
- Display professional courtesy and respect in all interactions related to this class

Compliance with these expectations will assist us with the creation of a learning community and a high quality educational experience. Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail 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 differences of race, color, culture, religion, creed, politics, veteran’s status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, please see:

[http://www.colorado.edu/policies/student-classroom-and-course-related-behavior](http://www.colorado.edu/policies/student-classroom-and-course-related-behavior) and
[http://www.colorado.edu/osc/information-students](http://www.colorado.edu/osc/information-students)
Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the academic integrity policy of the institution. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found responsible of violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code Council as well as academic sanctions from the faculty member. Additional information regarding the academic integrity policy can be found at http://honorcode.colorado.edu.

Students with Disabilities

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671 or by e-mail at dsinfo@colorado.edu, Center for Community N200, and http://www.colorado.edu/disabilityservices.

If you have a temporary medical condition or injury, see guidelines at http://www.colorado.edu/disabilityservices/students/temporary-medical-conditions.

Religious Observation

I respect individuals’ rights to follow their own religious expression. Please let me know if a religious observation conflicts with a due date. See full details of official campus religious policy at http://www.colorado.edu/policies/observance-religious-holidays-and-absences-classes-andor-exams.

Discrimination and Harassment

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. CU-Boulder will not tolerate acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CU’s Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU-Boulder’s Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at http://www.colorado.edu/institutionalequity/.
INTRODUCTORY PROJECT

The objective of this introductory project is for you to discover the different phases in the iterative process of engineering design: (1) design objectives and constraints; (2) development; (3) documentation and analysis of design ideas; (4) building; and (5) testing. This is a team project.

Problem Statement: Design a Solar Cooking Oven to be used to cook food during the summer months (June – September) in Boulder, CO. The oven must be able to reach temperatures exceeding 300° F (150° C).

Remark: To help you, check the web. There are many photos of solar cookstoves on the web. However, you are not limited to these systems. Be creative!

Deadline: The projects will be presented in class on September 14, 2017. The completed intro project reports are due on September 21.

Requirements:

1. Your final report must document the different phases of the design process your team went through. You may want to read Chapter 3 in “Introductory Engineering Design: A Projects-Based Approach.” Available on-line at: http://itll.colorado.edu/index.php/courses_workshops/geen_1400/resources/textbook/
2. Your final report must address the science of solar cooking. What physics principles are behind this? Why does it work?
3. Your report must provide a brief review of existing solar cooking ovens available on the market today (cost, limitations, advantages, disadvantages). Are any of them patented?
4. Your report must include a detailed description of:
   o supplies and equipment used (cost included)
   o data collected and analyzed
   o instructions and steps for construction
   o tips for using the oven
   o recommendations for improvement
5. Each student should not spend more than $25 towards supplies and expenses for this introductory project.

Your grade will be based on several criteria:
1. How closely you followed the design loop discussed in Chapter 3
2. The reporting of the different phases of the design process
3. How closely you met the aforementioned requirements
4. The performance of your system (higher temperature, lower cost)
5. The quality and taste of the food cooked with your oven.

Recommended web sites on solar cooking: Check the web under “solar cooking recipes”. Also, check https://www.sunoven.com/category/daily-solar-cooking-recipe/