ENGINEERING IN CONTEXT

HISTORY, SOCIETY, AND THE ENVIRONMENT

Rob Martello
Spring 2025

Engineering, science, technology, and math are fundamentally human endeavors, socially constructed and society-shaping. The dialogue between humans, our natural environment, and the technical world we have created is complex and fascinating.

Each Engineering in Context student will select a technical course you are concurrently taking and will use that course to explore its larger STEM discipline through lenses such as its ethical, environmental, and societal (historical, political, economic...) contexts and impacts. We will engage in readings, discussions, and projects that build a critical thinking toolkit for historical and contextual study, and students will also explore their chosen technical field individually or in small groups.

This course represents a novel approach towards interdisciplinary integration: you get to choose the course we'll connect with, and all of us will deepen the connection. And as a relatively new offering still open to modifications, we have many opportunities to work together to improve this learning experience throughout the semester. Join the fun and let's build something exciting!

AHSE 2100

4 AHS CREDITS

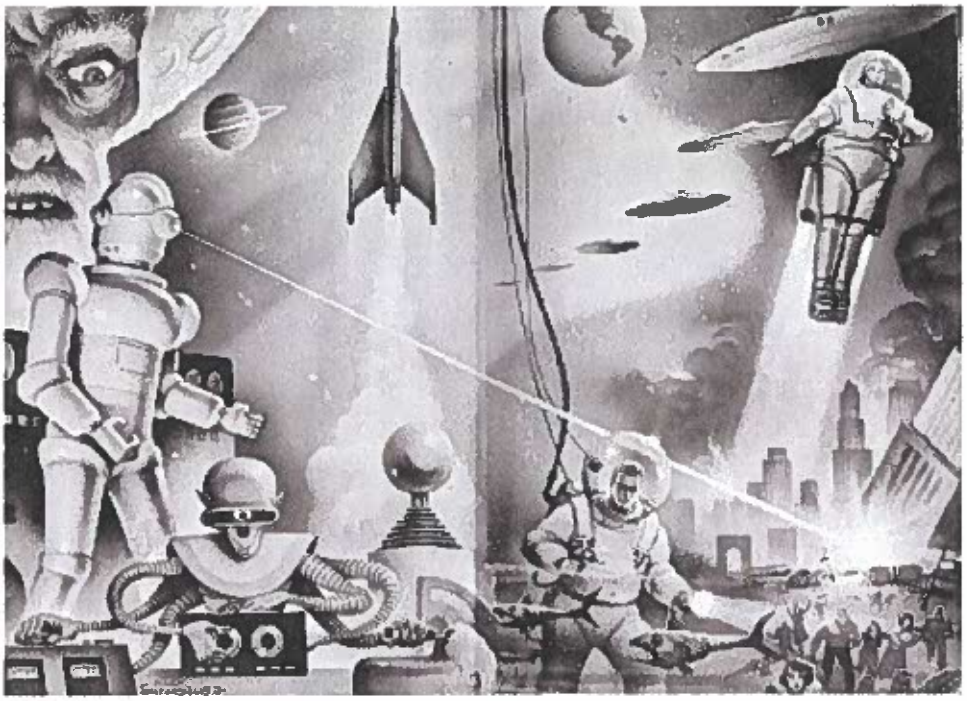
ALL STUDENTS WELCOME!

IN-CLASS ACTIVITIES

- Daily readings
- Interactive discussions
- Report-outs
- Fun with whiteboards
- "Storytime with Rob"
- Visits from dynamic Olin faculty

ASSIGNMENTS

- Research paper or poster related to your chosen field of study
- "Improve Olin" project (add context to Olin activities)
- Choose your own – lots of autonomy here!



SCIENCE FICTION AND HISTORICAL CONTEXT

ROB MARTELLO

Are you curious about how science fiction has shaped the ideals, technological innovations, and cultural norms of our society? Are you interested in seeing how our ever-changing political, economic, and cultural trends have influenced the conventions of science fiction writing? Do you want to learn new ways of reading and thinking about science fiction, to better interpret its many meanings and messages? And most important of all, are you in the mood to read, watch, and listen to a century's worth of amazing stories? Join the fun this spring in Science Fiction and Historical Context, where we will not only explore the interaction between sci-fi and society, but we'll also redesign and improve the course for future generations of Oliners, to infinity and beyond.

Spring 2025
4 AHS Credits

We'll enjoy sci-fi in media such as short stories, TV series, comic books, and more

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We'll explore sci-fi from the early 1900s to the present day

You get to choose which assignments you complete, from a menu that includes in-class presentations, reporting on additional readings, writing your own sci-fi, producing artwork or music, writing a report, or designing your own assignment

AHSE 2114

Science Fiction and Historical Context

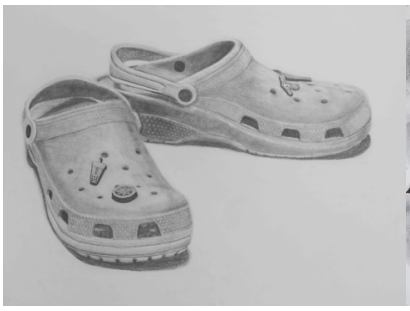
Questions?

rmartello@olin.edu

Spring 2025

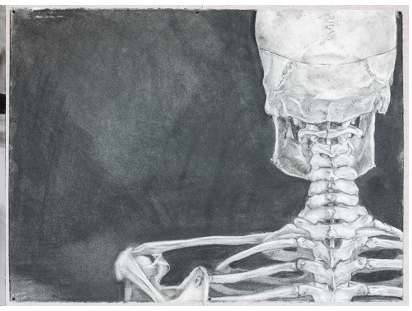
AHSE2131 Responsive Drawing and Visual Thinking

with Professor Donis-Keller



Megan Ku

Keeley Haverstock



Devynn Diggins

Flynn Michael-Legg

Kyle McCracken

Kyle McCracken

2020/2022 class projects

This can be fun, and you will probably surprise yourself with how well you can draw realistically by the end of the semester.

YOU *CAN* DRAW!

- This course assumes **NO** prior drawing experience.
- Those who already have a love of drawing are welcome too.
- FIELD TRIPS TO MUSEUMS!
- **Grades are based on improvement.**

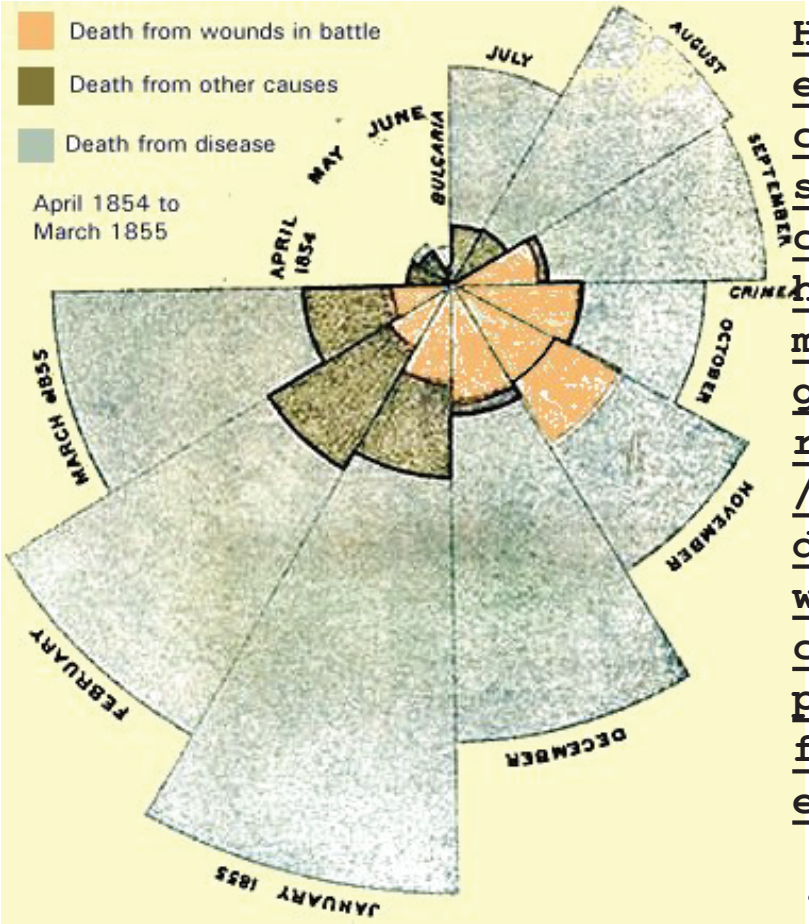
Everyone will make significant strides gaining freehand drawing skills, enhance their ability to observe, improve visual thinking skills, and produce awesome works of art.

In-class projects include life model drawing using graphite, charcoal, and conté with homework sketchbook assignments and 2 major projects

Prerequisites: Enthusiasm, willingness to have fun and work to achieve your goals

Questions? Helen.Donis-Keller@Olin.edu

AHSE2199C w/ dr. leah horgan



How does data shape empires and future cities? How does it shape our conceptions of the human body / nature / mental health / gender / sexuality / race / class / labor / and expertise? How does it influence the way we address complex social problems ranging from poverty to environmental crises?

DATA, DESIGN, DISASTER! A CRITICAL DATA STUDIES SEMINAR

Course Description: Data is world-making and deeply affects our everyday lives. In this course we'll trace the evolution of data and technology design as a tool of control used in governance, surveillance, science, and industry -- from early empires to our current era of big data. We will explore how data practices have been instrumental in shaping major disasters of our lifetime; the rise and fall of empires; the (mis)functioning of modern nation-states; our collective conceptions of the body, health, gender, sexuality, race, class, labor, and expertise; and the way we address complex social problems ranging from poverty to environmental crises. Through critical analysis of key readings and real-world examples, students will gain a deep understanding of the intricate relationship between data, politics, and the potential for data-driven technologies to either empower or oppress. While this course is focused on reading and discussion, students will have the opportunity to utilize data science and speculative design approaches, and help co-create the course curriculum.

Writing Just Got Real.

Wonder how to write an email to someone you don't know on LinkedIn that will get a response? Cover letters making you run for cover? Wish your online bio did you justice? Want to write an application essay or scholarship essay that makes your reader pay attention? Then come join an exciting 6-week adventure focused on upping your game in day to day professional writing that can open doors and create connections.

Each of our four modules will feature a fundamental **professional writing challenge** (emails, cover letters, bios, and personal statements); **specific writing skills and habits of mind** that will help your writing stand out; a fun (yes, fun!) focused **writing assignment embedded in your real world practice**; specific **expertise and examples from one or more additional teaching partners across our Olin faculty and staff**; and lots of time in class for audience feedback and revision! Come do the writing you need with the support you want!

The Course:	**Writing Gets Real**
The Instructor:	**Gillian Epstein** (plus guest faculty, staff, or alumni partner each week!)
The Credits:	**2 Authentic and Amazing AHS Credits**
The Timing:	**First half of the Spring semester** (6-week course)
The Reason:	It can take years to gain confidence and experience in professional day to day writing. Fast forward through time and up your writing game today!

MechProto

Introduction to Mechanical Prototyping
Spring 2025

Interested in **trying out ME**?

Want a **foundation in basic mechanical design elements**?

Want to flex your **existing ME skills**?

MechProto is the course for you!

Questions? Email Georgia Van de Zande

Environmental Analysis and Science (EAS)

Scott Hersey

Do you want to gain experience with community-engaged environmental analysis for impact? Are you interested in learning quantitative approaches to analyzing environmental systems? Curious how environmental data are collected and analyzed with lab instrumentation and software packages? Want to gain experience translating environmental insights into actionable steps for non-expert stakeholders like elected officials, advocacy groups, and residents? If you answered yes to any of those questions, you'll find a home in Environmental Analysis and Science (EAS)!

EAS At a Glance

- Choose 4 credits of: SCI, ENGR, **or** Intro to Sustainability;
- 3 main course sections: a) Air quality analysis and insights for community partners in Boston, b) Water quality analysis for Boston's Muddy River with partners CRWA, and c) Soil contamination analysis for partners in Boston;
- Activities include air quality data analysis and insight generation in R, water sample collection in the field, analysis of water samples in the laboratory, soil sample collection and laboratory analysis, written and oral communication of analysis insights to diverse audiences, and in-class data workshops;
- Meets twice per week for 100 minutes.

ENGR 3199

College as a Living Lab: Building Energy & Operations Optimization
Spring 2025

Instructors

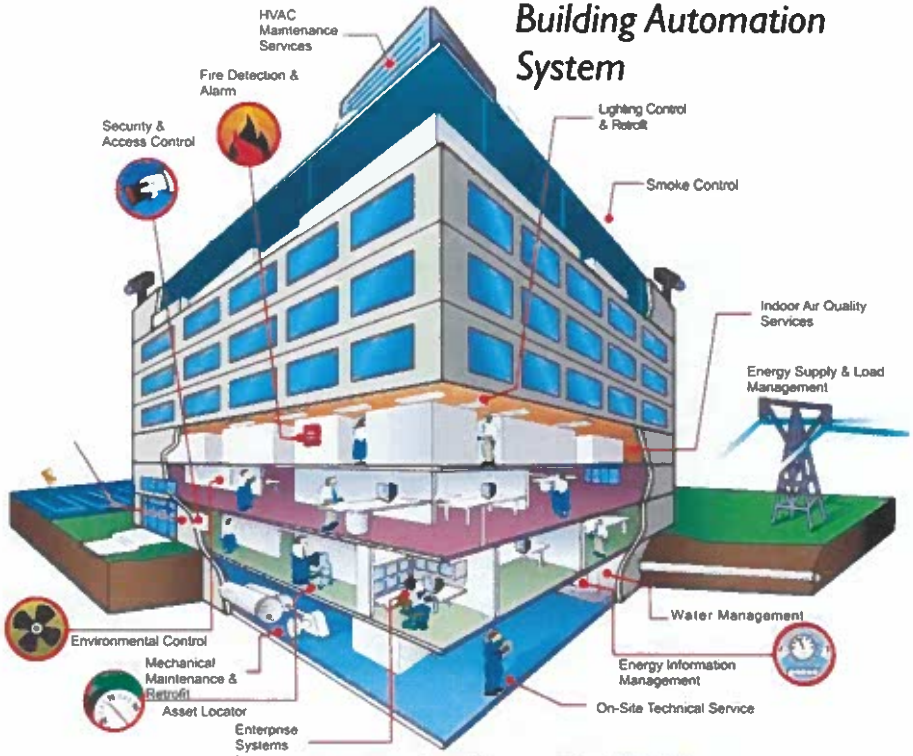
- Victoria Dean | Alessandra Ferzoco | Claire Rodgers | David Shuman

Did You Know

- In 2019, natural gas and electricity for Olin's campus made up 58.7% of Olin's measured greenhouse gas emissions (see Climate Action Plan)
- Heating, ventilation, and air conditioning (HVAC) make up a large part of this on-campus usage
- Olin has several years of HVAC data for our buildings [~737M data points across 601 pieces of hardware and 5 years], and we continue to collect such data every 15 minutes

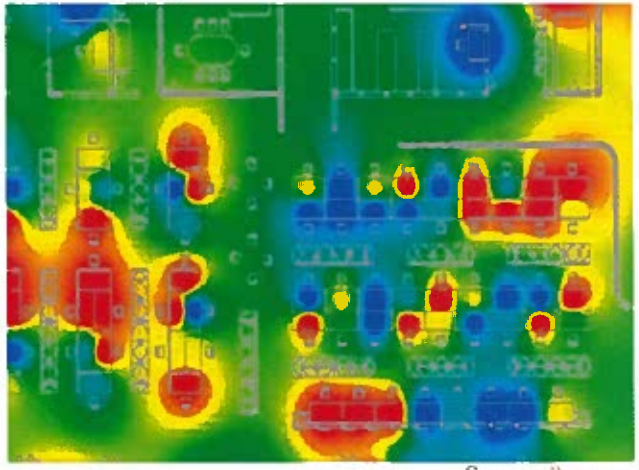
Course Description

This impact-centered learning experience is aimed at improving Olin's building automation and HVAC systems through projects around fault detection and energy efficiency. Throughout the year, groups will work on sub-projects with different topics/goals, including visualization and interpretation of campus data, machine learning on campus data, thermal modeling of campus buildings, software infrastructure to get data on and off of the HVAC control servers, and more. We may collaborate with Franklin Cummings Tech Prof. John Terasconi and some students from FCTech's Building Energy Management program.



Source: IndiaMart

"Heat" Map



Source: Remsdaq

Prerequisites

Any one of the following:

- Intro to Thermal-Fluid Systems (or equivalent)
- Machine Learning, Data Science, or NeuroTech (or equivalent)
- SoftSys

Registration Details

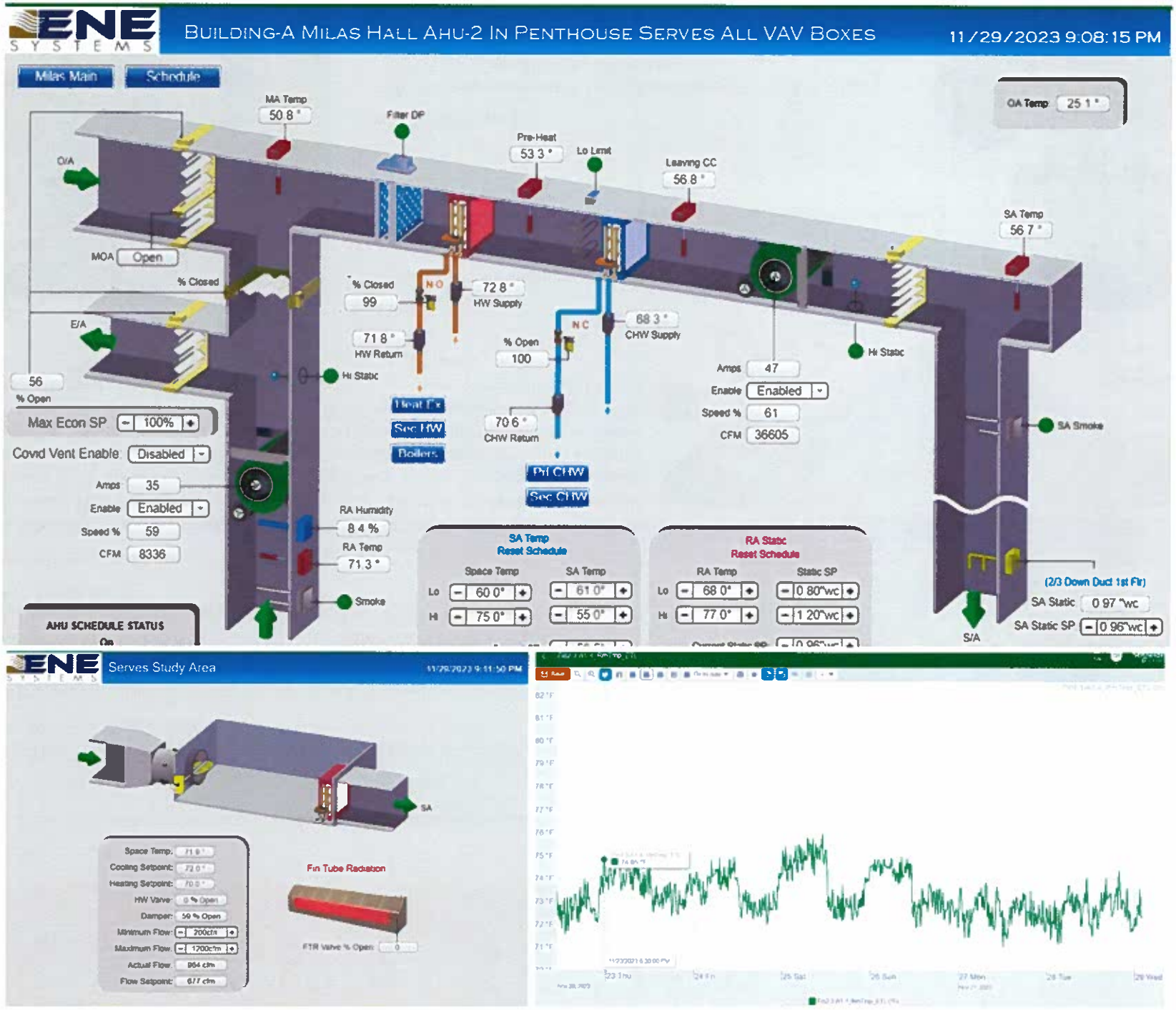
- 4 ENGR credits
- Counts as an elective for E:Sustainability, E:Robotics, E:Computing, MechE, E:Design
- Counts as a designated alternative for Thermal-Fluid Systems Analysis

Questions?

See Prof. Victoria Dean or email vdean@olin.edu

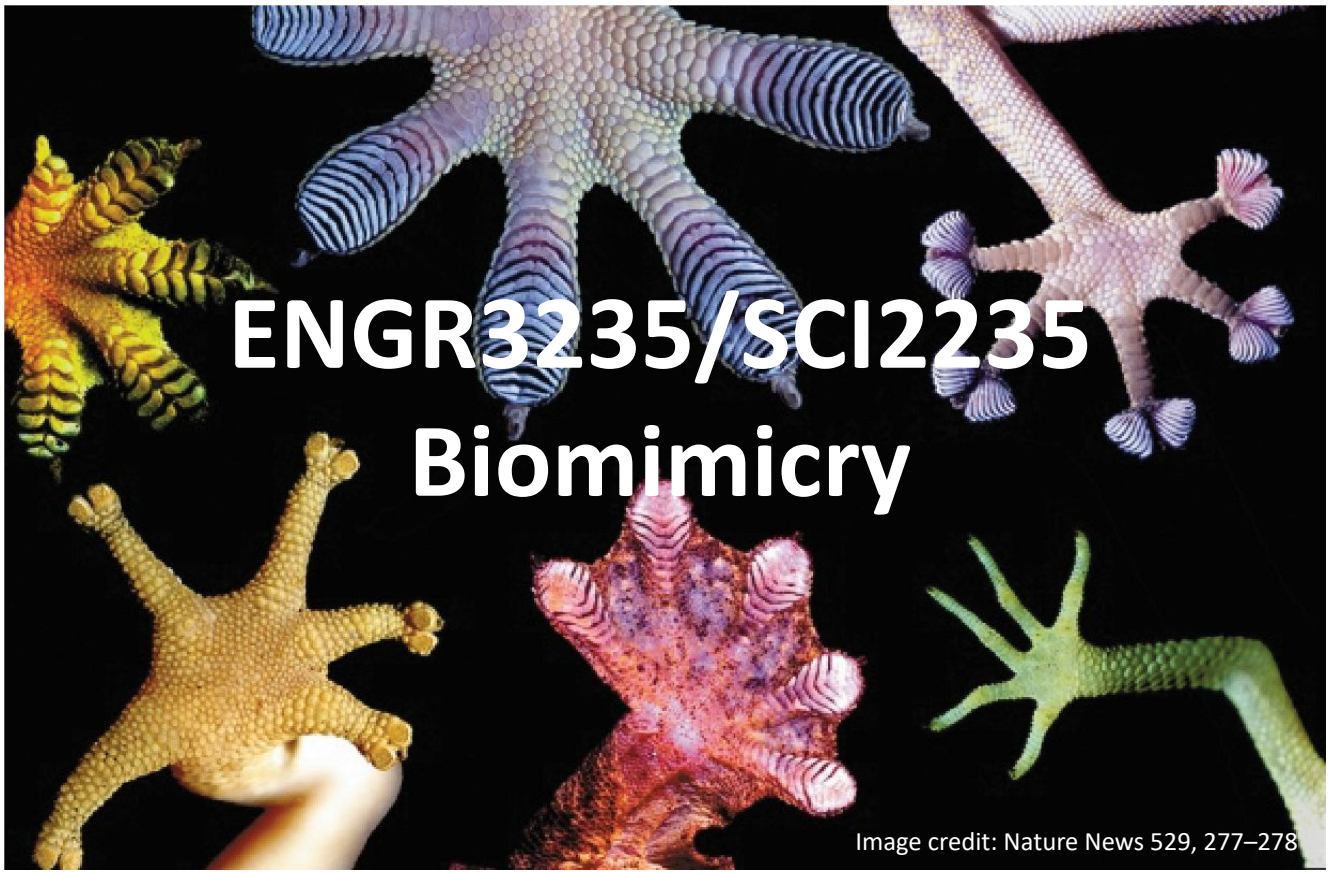
Chiller & Boiler

Live Building Operation Dashboard



Spring 2025

"Nature as model, measure and mentor" -Janine Benyus



We can learn from nature! From studying a leaf to make a better solar cell to emulating natural processes to develop living buildings, the discipline of Biomimicry views nature as "model, measure and mentor" (Benyus, 1997). Spiders spin protein silk with the strength of steel yet much lighter all at ambient temperature and pressure. Cuttlefish change color to match their surroundings in milliseconds by contracting their chromatophores and even bioluminesce. In this course we will study wonders like these to appreciate the beauty and sophistication of life by investigating the biological mechanisms and functions of organisms as well as the dynamics of whole ecosystems. By examining biological systems at multiple scales, we can draw insights from understanding how they work. By collecting data, running experiments, creating models, or building prototypes, we can translate these insights into design ideas and practice. We will examine and discuss big ideas and thinking in biology and design and then synthesize and reflect on the intersection of these fields. Students will develop skills and insights through critical analysis of readings and the development of projects that draw on both fields. Biological systems have undergone 3.8 billion years of evolution, resulting in time-tested approaches to living on earth that are efficient and embody sustainability. By exploring the intersection of biology and design, we might learn to do the same.

Fulfills Design Depth or Intermediate Level Biology, Sustainability Concentration Elective
Co-requisites: CD, Principles of Modern Biology

Benjamin Linder (blinder@olin.edu), Jean Huang (jean.huang@olin.edu)

ENGR3242: Quantitative Engineering Design: Design Optimization
Instructor Jesse Austin-Breneman

Course Description

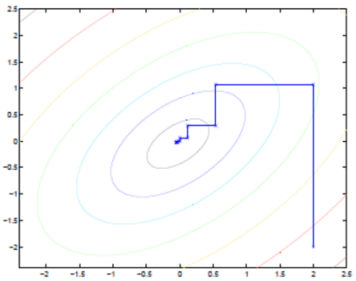
Want to design not just a good system, but the best system? Well, then QED is the course is for you! The engineering design process can often be completed more quickly and efficiently by applying quantitative analysis at various points within an optimization framework. In this course, students will apply their existing skills and knowledge and learn new tools to perform quantitative analysis in the context of the design process. These concepts will be applied throughout a semester-length project optimizing the design of a system of your choice. Ever wondered what are the best character choices for Mario Kart or what the powertrain of the most efficient electric vehicle looks like? Turns out you can use the same techniques to answer both questions. Sessions will focus on learning new modeling techniques, such as regressions or kriging, and new optimization algorithms, from gradient descent to particle swarm. We will then apply them to your system to iterate towards an optimal solution.

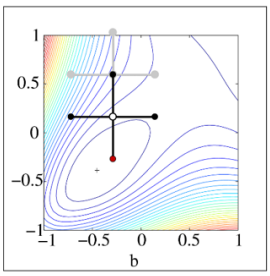
After taking this course you should be able to …

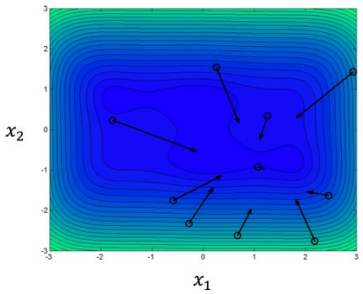
- Formulate design optimization problems from real-world situations
- Develop and apply the appropriate optimization algorithm to solve your formulation
- Articulate and motivate your modeling and optimization choices

Why you should take this course …

- You want to be able to visualize and understand trade-offs when designing the complex non-linear systems common in actual engineering problems
- You want to make good design decisions, well at least better than a random walk through a really large design space, and you're not sure how
- You've always wondered exactly how does Chat-GPT work really?
- You want to be the very best, like no one ever was







FAILURE!

Failure Analysis & Prevention

ENGR3820/SCI3420

Jon Stolk

Plan and implement hands-on investigations of failed components and products.

Learn theory on failure modes and mechanisms. Develop your analytical and design skills.

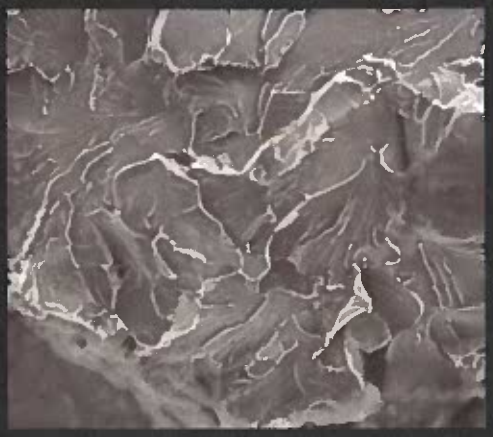


Image credits: Lenore Abbot (left), Allison Li, Joanna Sims, and Xander Hughes (middle and right)

Critically examine contextual factors of failure, like people, processes, policies, and standards.

Understand systemic failures by exploring historical and present-day failure case studies.

Image sources (left to right): The New York Times, The New York Times, Phil Degginger / Landsat / NASA

AFFORDABLE DESIGN AND ENTREPRENEURSHIP

Design Justice Studio

ADE is becoming DJS!

ENGR 3290 - Olin College – **DESIGN DEPTH**
ENGR 4290 - Olin College – **CAPSTONE**
EPS 4515 - Babson College

Offered: Fall, Spring
Prerequisites: ENGR 2250 for Olin Students; Junior or Senior standing

MISSION

Inspire and educate students to work with people in communities to address challenges endemic to contexts of injustice through design and entrepreneurship.

COURSE DESCRIPTION

This course engages students in community-based, participatory design and action. Teams partner with communities and organizations to achieve positive social and environmental impact with a strong justice framing, working for change in areas like air quality, community development, food processing, global health, and just energy over several semesters.

Guided by an experienced faculty advisor, teams make change through design for impact, social entrepreneurship, community organizing, participatory research, political advocacy and other practices. Teams work using theories of change, assumption testing, power analysis, dissemination of innovation, and ethical norms. Students regularly engage primary parties in inclusive processes, in person and virtually, to observe, strategize, plan, co-design, prototype, test, and implement approaches supported by a significant project budget. There are often opportunities to travel locally, nationally, or internationally to work with partners. Students are exposed to mindsets and dispositions for working with integrity and responsibility in their primary-party contexts through guided exercises, case studies, guest speakers, readings, and reflections. Students learn and apply changemaking practices through project work, and gain essential experience building relationships across difference and developing their own self- and cultural awareness.

LEARNING OBJECTIVES

1. Identify principles and examples of practices that are primary-party-centric, participatory, community-based, and accountable to communities and collaborators.
2. Engage across differences and power imbalances to build trust and productive working relationships with primary parties and collaborators.
3. Reflect on personal and professional obligations and identity development in ways that connect course activities with longer-term life and career goals.
4. Articulate and iterate a theory of change for working for justice in a specific context.
5. Test assumptions that underlie a theory of change in order to help determine how to advance and de-risk a project.
6. Engage in design and strategy development to create or evolve a plan to ensure the sustainability of a project.
7. Take responsibility for and apply a diverse set of practices that foster team health.

AFFORDABLE DESIGN AND ENTREPRENEURSHIP

ADE TRACKS

There are 5 tracks in ADE with a team working in each area. All teams share broader change-making practices, including theory of change, assumption testing, power analysis, dissemination of innovation methods, and ethical norms. And each team has its own particular practices for making change, which are typically a combination of community organizing, public policy advocacy, participatory research, design for impact, and social venturing.

Air Quality — Massachusetts

Reducing the burden of air pollution in near-source communities by building awareness and capacity for agency.

Community Development — Miss, Mass

Creating equitable access to hands-on learning for 9-15 year-olds that build self-confidence, invite creative self-expression, and inspire community action, catalyzing cycles of success to disrupt structural exclusion

Food Processing — Ghana

Creating mini post-harvest processing machines accessible to women to reduce gender inequality, increase local food security, reduce burden, and grow small businesses.

Global Health — Americas

Increasing early access to hearing screening devices to enhance immediate well-being of children and improve their overall life outcomes.

Just Energy — Mass, United States

Enabling community-based renewable energy and supporting energy-related autonomy for Indigenous peoples through Just Transition principles.

Image from Sacred Earth Solar

Level: Design Depth, Engineering Capstone

Advisor: Chhavi Goenka

ADE: Just Energy

Energy from fossil fuels is inherently unjust; it is an extractive model that aggregates benefits to the economically advantaged while externalizing costs (cultural, health, environmental) to the politically disenfranchised. We define "Just Energy" as renewable energy captured and stored through processes that feed and grow the Climate Justice Alliance outcomes: re-localized wealth, democratic governance over community resources and work life; ecological and social well-being for communities; and a caring and sacred world view.

We aspire to create a renewed relationship to energy by design–one that integrates justice and technical considerations to create equitable access while addressing the economic, environmental, and ecological processes involved. We are learning how to build relationships with Indigenous communities, how to co-create projects with them, and how to build technologies around renewable energy to address community needs including energy-related autonomy. We will need a range of technical skills, from ME to ECE to Design to Computing, to transition to community-based renewable energy. In addition to these technical skill set, humility, care, and an openness to learn and re-educate ourselves are critical to this work.

Farfetching:
Artifacts from Futures We Want

Experimental Design Studio
Spring 2025

Bring your creativity, your design and fabrication skills, and your clear-eyed optimism to this experimental course in design fiction and speculative design.

From a single material artifact, archaeologists can infer an enormous amount about the society that produced it. In this course, we'll turn that inside-out: instead of using an object from the past to learn about the culture around it, we'll engage deeply with futures we want to live in, and we'll design and fabricate artifacts to embody that understanding – in effect, bringing a small, concrete piece of that future into the present day.

We now have most of the technologies we need for everyone to thrive within our planetary boundaries of energy and matter. It's time to imagine what that world might be like, so we can do the work of building it.

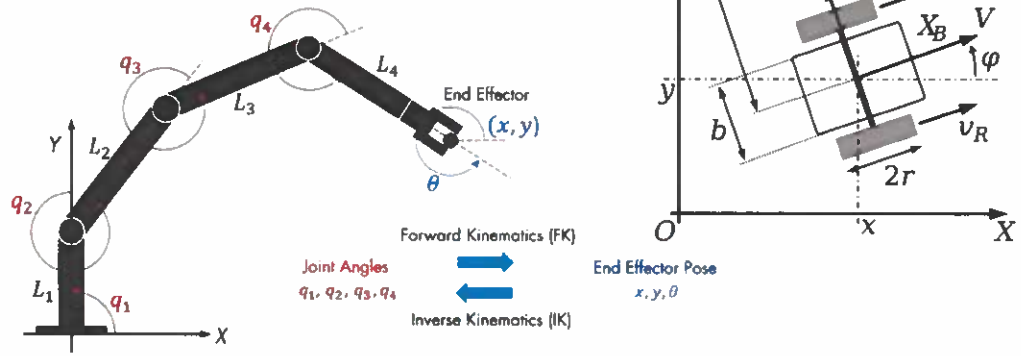
Design Depth *(must have taken or be concurrently taking Collaborative Design)*
4 ENGR credits, **Experimental Grading**

Want to learn more? **Deb Chachra dchachra@olin.edu**

NEW Fundamentals of Robotics (FunRobo)

Fundamental concepts you'll learn

- Robot Arm Kinematics
- Wheeled Robot Kinematics
- Robot Control
- Robot Trajectory Planning
- Robot Navigation
- And more...



How you'll apply the concepts

Build and Integrate a Mobile Manipulator Robot

Course Prerequisites

- Experience with sensor & actuator integration (**PIE equivalent**)
- Some experience with Python programming

What does this count for?

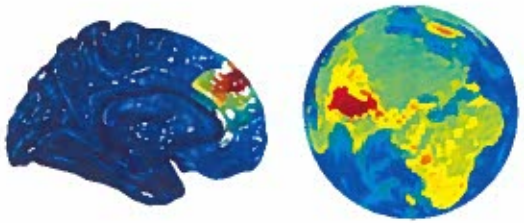
- **4 ENGR** (welcome to all)
- **Required** E:Robo foundation
- ECE Elective

python™

ENGR 3415 | Digital Signal Processing
Spring 2025 | Prof. David Shuman

What Are Signals?

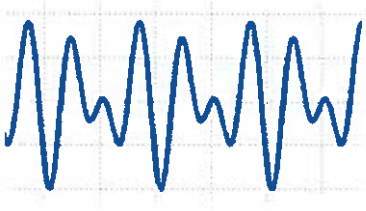
Signals are functions or discrete data sequences that convey information. You generate and interact with signals every day, every minute, every second. Your heartbeat, your selfies, a soundtrack from your favorite musical artist, your bank account balance, the motion of your sprint to an early morning class, and your scream of joy when you've successfully registered for DSP are just a few examples of signals.



Signal Processing Applications

How can we remove the noise from this image?

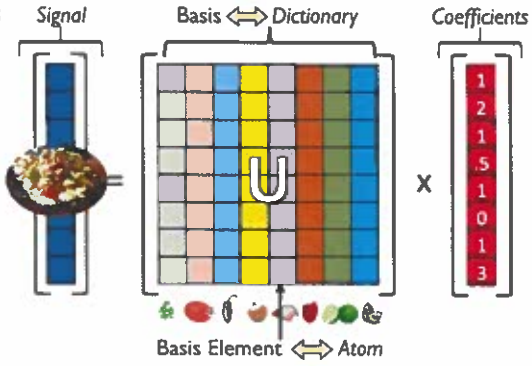
How can we compress the information in this signal down to just a few numbers?



How can we analyze and approximate signals at different levels of resolution?

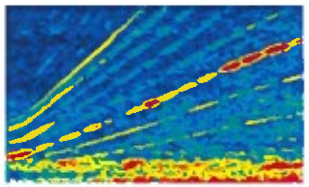
Course Description

The main idea of the course is that transforming a signal from one domain into a different domain often makes it easier to analyze the signal, compress and communicate the signal, or alter certain properties of the signal. We'll start by examining how signals such as audio clips and images can be broken down into combinations of basic building blocks (analysis), and how those fundamental building blocks can be combined into far more complicated signals (synthesis). We'll then examine the theory and applications of Fourier transforms, discrete cosine transforms, wavelet transforms, and time-frequency transforms. Along this journey, we'll encounter classical results such as the Nyquist-Shannon sampling theorem and the Heisenberg uncertainty principle, as well as modern signal processing ideas revolving around sparse representations. Applications will be drawn from audio and speech processing, graph signal processing, medical imaging, physics, geology, biology, finance, and other disciplines.



Coursework

Most classes will feature a mixture of mathematical theory and computational programming activities. There will also be plenty of space for interested students to explore hardware projects. Students will play a role in co-designing the syllabus and content. I'd love early feedback on what interests you the most.



Prerequisites & Requirements Satisfied

ENGR 2410, Engineering Systems Analysis: Signals is the official prerequisite. Speak with David if you are interested in taking DSP but haven not taken ESA: Signals. This course counts for 4 ENGR credits and the restricted elective requirement for the ECE major.

Questions?

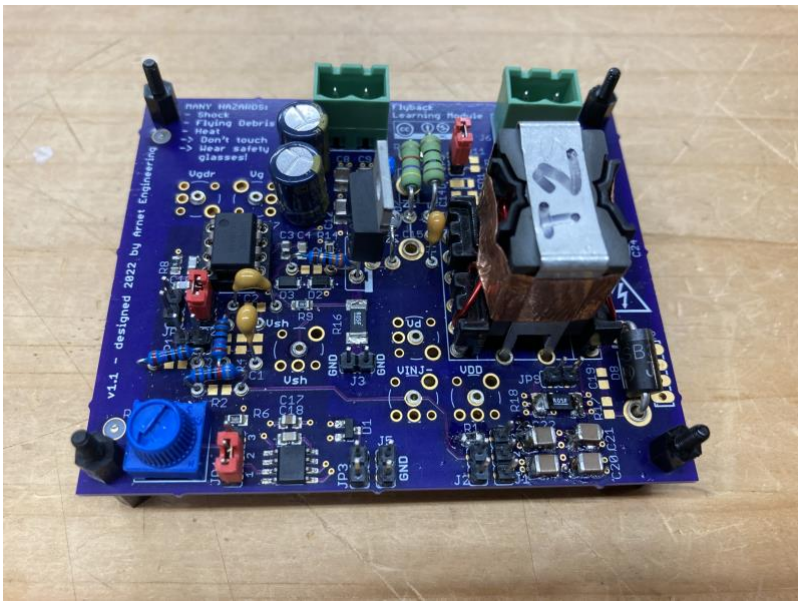
See Prof. David Shuman or email dshuman@olin.edu.

Introduction to Power Electronics

Take this course if you are interested in solving environmental and energy problems

In this course, the student will learn the fundamentals of power electronics in the context of DC-DC switched-mode power supplies. The material studied is multidisciplinary, covering the analysis and control of power-converter topologies, design and fabrication of magnetic components and realization of MOSFET powerstages. The theory is taught in an applied and design-oriented fashion through simulation-based circuit analysis and hands-on and collaborative experimentation. It is a primary objective of this course to apply fundamental concepts with the aim of developing an intuitive big picture understanding and to encourage independent exploration.

The applied component of the class is centered around a low-voltage flyback converter. The lesson modules will gradually build up the necessary knowledge to design and build a custom flyback transformer, specify key powerstage components including snubber and clamping circuits and realize an analog closed-loop voltage controller.



Topics that will be introduced/revisited include:

- Modeling and simulation of switched-mode topologies
- Reading datasheets and extracting key information for modeling and design purposes
- Electromagnetic principles for the design of inductors and transformers
- Semiconductor operation and loss calculations
- Selection of powerstage components (MOSFET, filter capacitors, gate-drivers)
- Protection circuits and snubber design
- Calculating and measuring transfer functions
- Tuning and implementing analog control loops (loop shaping method)

Students will be asked to complete pre- and post-class assignments, and to provide weekly evidence of their explorative work by submitting engineering notes with original content. At the end of the course, we will present our work and findings to interested Oliners by means of a public tabletop exhibit.

Advanced Algorithms

Instructed by Rucha Dave, Aditi Vinod, Maya Cranor, Anmol Sandhu
Advised by Victoria Preston and Rob Martello

What will you do?

- First portion
  - diving into concepts with a mixture of interactive lectures and problem based approaches
  - Algorithmic proof and explanation problems and implementation problems (in Python)
- Final project
  - Open-ended where you can investigate another algorithm we haven't seen in class

Why should you take it?

- Interested in furthering your CS knowledge beyond data structures and algorithms
- Learn cool, relatable content which is very applicable to common real-world problems
- Want lots of buzzwords on your resume
- Want a fun E:C elective
- All lectures will be recorded!

Please scan to complete our Google form!

For more information, email Rucha Dave (rdave@olin.edu), Aditi Vinod (avinod@olin.edu), Maya Cranor(mcranor@olin.edu) or Anmol Sandhu(asandhu@olin.edu)

Prerequisite: Software Design, Discrete Math or permission from instructor

Advanced Algorithms

Instructed by Rucha Dave, Aditi Vinod, Maya Cranor, Anmol Sandhu
Advised by Victoria Preston and Rob Martello

For more information, email Rucha Dave (rdave@olin.edu), Aditi Vinod (avinod@olin.edu), Maya Cranor(mcranor@olin.edu) or Anmol Sandhu(asandhu@olin.edu)

Prerequisite: Software Design, Discrete Math or permission from instructor

AFFORDABLE DESIGN AND ENTREPRENEURSHIP

Design Justice Studio

ADE is becoming DJS!

ENGR 3290 - Olin College – **DESIGN DEPTH**
ENGR 4290 - Olin College – **CAPSTONE**
EPS 4515 - Babson College

Offered: Fall, Spring
Prerequisites: ENGR 2250 for Olin Students; Junior or Senior standing

MISSION

Inspire and educate students to work with people in communities to address challenges endemic to contexts of injustice through design and entrepreneurship.

COURSE DESCRIPTION

This course engages students in community-based, participatory design and action. Teams partner with communities and organizations to achieve positive social and environmental impact with a strong justice framing, working for change in areas like air quality, community development, food processing, global health, and just energy over several semesters.

Guided by an experienced faculty advisor, teams make change through design for impact, social entrepreneurship, community organizing, participatory research, political advocacy and other practices. Teams work using theories of change, assumption testing, power analysis, dissemination of innovation, and ethical norms. Students regularly engage primary parties in inclusive processes, in person and virtually, to observe, strategize, plan, co-design, prototype, test, and implement approaches supported by a significant project budget. There are often opportunities to travel locally, nationally, or internationally to work with partners. Students are exposed to mindsets and dispositions for working with integrity and responsibility in their primary-party contexts through guided exercises, case studies, guest speakers, readings, and reflections. Students learn and apply changemaking practices through project work, and gain essential experience building relationships across difference and developing their own self- and cultural awareness.

LEARNING OBJECTIVES

1. Identify principles and examples of practices that are primary-party-centric, participatory, community-based, and accountable to communities and collaborators.
2. Engage across differences and power imbalances to build trust and productive working relationships with primary parties and collaborators.
3. Reflect on personal and professional obligations and identity development in ways that connect course activities with longer-term life and career goals.
4. Articulate and iterate a theory of change for working for justice in a specific context.
5. Test assumptions that underlie a theory of change in order to help determine how to advance and de-risk a project.
6. Engage in design and strategy development to create or evolve a plan to ensure the sustainability of a project.
7. Take responsibility for and apply a diverse set of practices that foster team health.

AFFORDABLE DESIGN AND ENTREPRENEURSHIP

ADE TRACKS

There are 5 tracks in ADE with a team working in each area. All teams share broader change-making practices, including theory of change, assumption testing, power analysis, dissemination of innovation methods, and ethical norms. And each team has its own particular practices for making change, which are typically a combination of community organizing, public policy advocacy, participatory research, design for impact, and social venturing.

Air Quality — Massachusetts

Reducing the burden of air pollution in near-source communities by building awareness and capacity for agency.

Community Development — Miss, Mass

Creating equitable access to hands-on learning for 9-15 year-olds that build self-confidence, invite creative self-expression, and inspire community action, catalyzing cycles of success to disrupt structural exclusion

Food Processing — Ghana

Creating mini post-harvest processing machines accessible to women to reduce gender inequality, increase local food security, reduce burden, and grow small businesses.

Global Health — Americas

Increasing early access to hearing screening devices to enhance immediate well-being of children and improve their overall life outcomes.

Just Energy — Mass, United States

Enabling community-based renewable energy and supporting energy-related autonomy for Indigenous peoples through Just Transition principles.

Image from Sacred Earth Solar

Level: Design Depth, Engineering Capstone

Advisor: Chhavi Goenka

ADE: Just Energy

Energy from fossil fuels is inherently unjust; it is an extractive model that aggregates benefits to the economically advantaged while externalizing costs (cultural, health, environmental) to the politically disenfranchised. We define "Just Energy" as renewable energy captured and stored through processes that feed and grow the Climate Justice Alliance outcomes: re-localized wealth, democratic governance over community resources and work life; ecological and social well-being for communities; and a caring and sacred world view.

We aspire to create a renewed relationship to energy by design–one that integrates justice and technical considerations to create equitable access while addressing the economic, environmental, and ecological processes involved. We are learning how to build relationships with Indigenous communities, how to co-create projects with them, and how to build technologies around renewable energy to address community needs including energy-related autonomy. We will need a range of technical skills, from ME to ECE to Design to Computing, to transition to community-based renewable energy. In addition to these technical skill set, humility, care, and an openness to learn and re-educate ourselves are critical to this work.

The Theory and Application of Algebraic Structures

Professor Sarah Spence Adams

Math 3199: Adaptable to your major or area of interest

Did you know that machine learning is a big pile of linear algebra?

Did you know that eigenvectors helped the Loggerhead turtle population rebound in the Southeastern US?

Did you know that a recent survey of E:Robo students/alumni indicated a desire for more linear algebra?

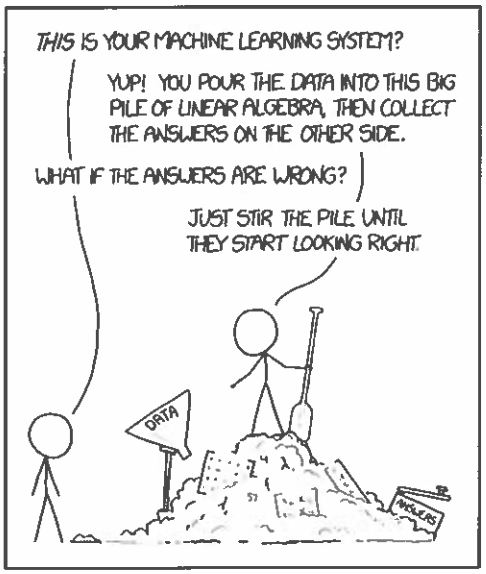
Did you know that modern cryptosystems & error-control codes rely on abstract algebra concepts such as Galois fields?

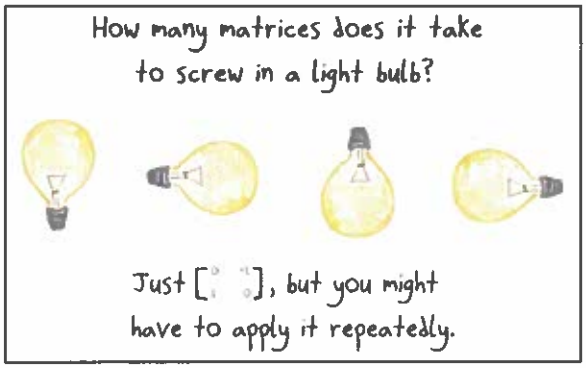
Did you know that ChatGPT says that mechanical engineers use linear algebraic tools such as least squares approximation, linear transformations, principal component analysis, and singular value decomposition?

In this new course, students from all (or most*) majors will have the opportunity to improve their quantitative knowledge/skills related to linear algebra, abstract algebra, or other algebraic structures, and apply their new learnings to applications relevant to their major or personal interests.

Students will begin their quests by deciding which topics in the broad area of algebraic structures may be useful/interesting for their majors and future goals. This might involve contacting people (e.g., industry professionals, graduate students, professors at Olin or elsewhere) for input. Students will then work in small groups to propose, plan, and execute a series of tasks/projects/experiences that facilitate their learning and application of new content.

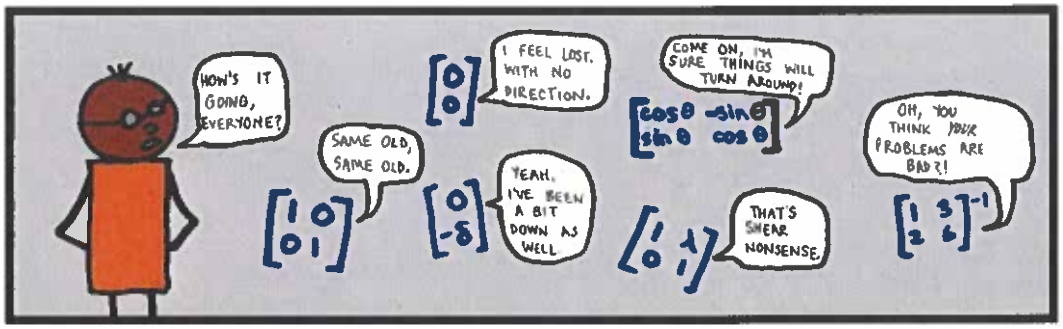
Some full-group lessons/assignments on key content or applications in linear/abstract algebra will occur, however, for the most part, students will need to take initiative to articulate their learning goals and craft experiences to achieve those goals.





This class is a great match for students who have finished QEA 1 & 2 and are motivated to significantly challenge themselves through setting goals and sustaining their efforts towards achieving those goals. Students in the first offering found value in deciding what to learn and how to learn it, yet many found this to be much more challenging than expected.

*This course has been approved to count as the advanced math requirement for ME and E:Robo majors. For others, please ask faculty who teach in your major to ascertain if this can count as a major requirement. Otherwise, enjoy this course as a useful elective that can be made relevant to nearly any area of interest!

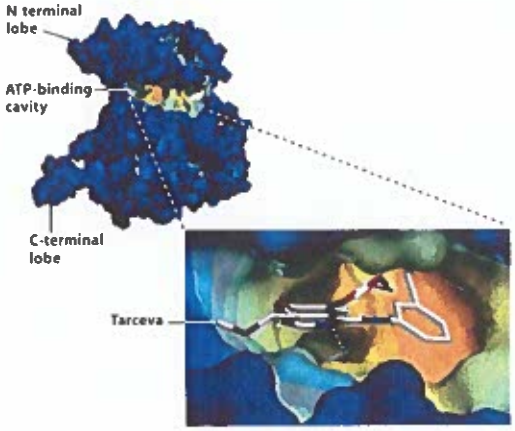


Comics taken from http://xkcd.com, https://mathwithbaddrawings.com/, and https://curiosamathematica.tumblr.com/

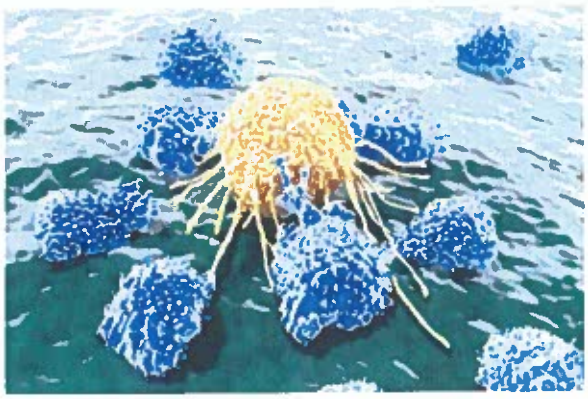
SCI1240: Designing Better Drugs

In this class, you will learn to apply concepts and laboratory skills that are currently used in biological research to solve problems in health and disease and drug discovery and development. You will develop an understanding of the larger societal context in which biological concepts, tools and research play a role in everyday life and medicine, how societal context shapes the advancement of research in biology and medicine and how climate change will impact global health. You will also develop skills in technical writing and oral communication and gain experience with the basics of designing, conducting and evaluating laboratory experiments.

This course addresses the Sustainable Development Goal of "Good health and well-being" (among others) and the engineering grand challenge of Engineering Better Medicines.

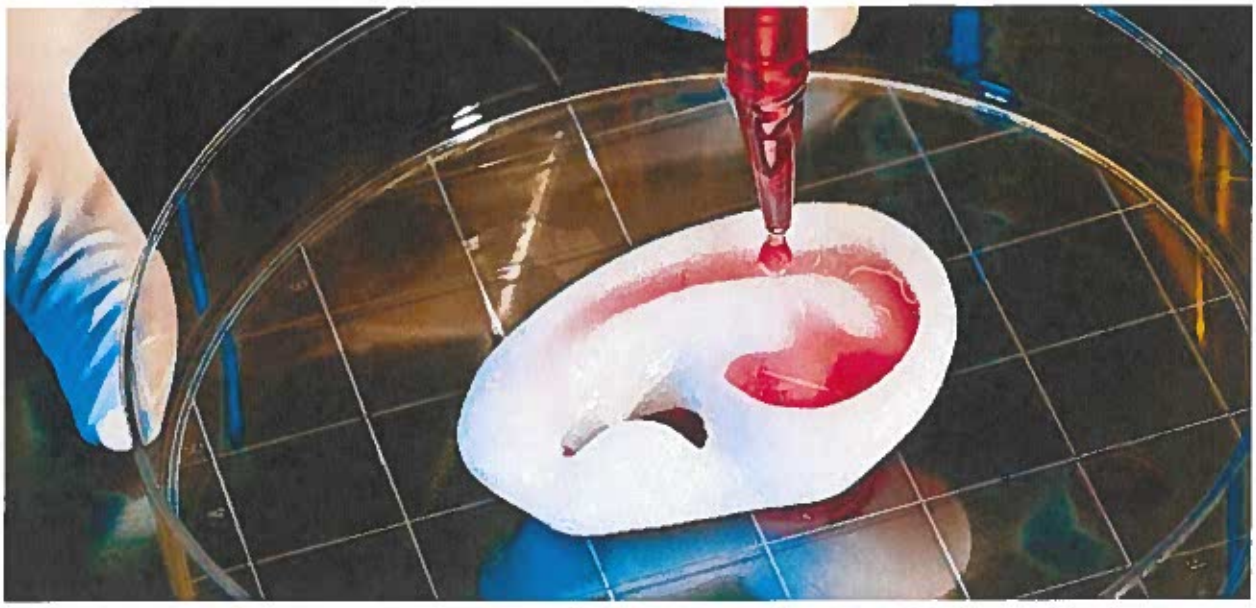


Tarceva fits in target's groove and blocks its activity. The target of Tarceva is mutated in many forms of cancer including lung and pancreatic cancers. Understanding the biochemical basis of disease aids in developing effective and specific therapies that minimize side effects in patients.



Immunotherapy: T cell attacking cancer cells
One of the most exciting areas in treatment of diseases is leveraging the immune system to destroy infected cells or cancer cells.

This class fulfills the Olin foundation Biology requirement.
Prerequisites: none
Instructor: Joanne Pratt
Lab Instructor: Michael Fannon



Intro to Tissue Building

SCI1299: Topics in Foundational Biological Sciences

with Michael Fannon mfannon@olin.edu

Although the ideas of regrowing limbs, replacing tissue and organs, and bringing people back to life has been the stuff of myths and legends, and more recently science fiction, it is now our reality. What seemed impossible just in the latter part of the twentieth century is part of our everyday life. We now possess the means, for the first time in human history, to alter the very genetic structure of life. This represents enormous potential and with it, enormous responsibility, because the direction we go in, and the choices we make, can change the course of humanity.

In this course we will learn the foundation of biological principles and apply them to the field of tissue engineering. A large part of this course will be spent in the laboratory learning the basics of the field. In addition, we will have guest speakers who are working in the field, who will provide unique perspectives on their work and the field in general.

"We'll make you an even smarter student."

4 Credits Science

In this hands-on course, you'll:

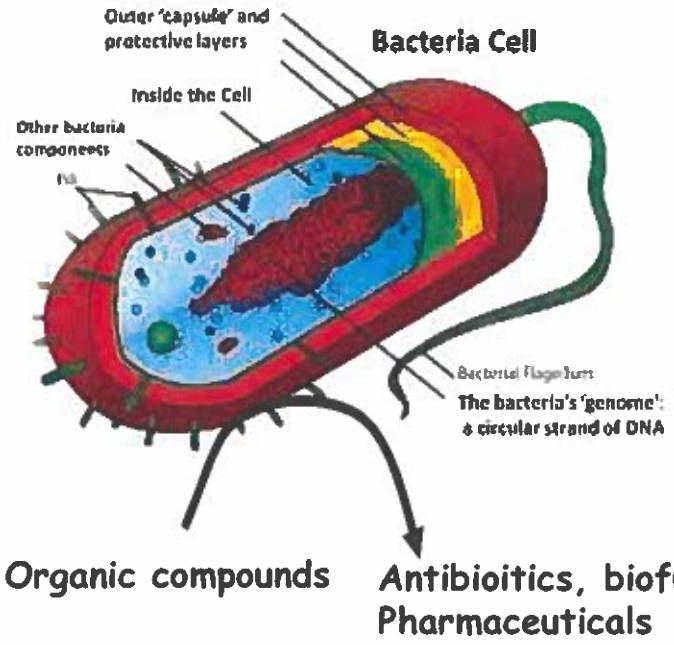
- Learn tissue culture techniques
- Formulate hydrogels for sustained-release mechanisms
- Do recombinant DNA transformation

Explore the microbial world!

SCI2214: Microbial Diversity

Olin College, Spring 2025

Credits: 4 SCI, advanced bio



"We Are Our Bacteria" By Jane E. Brody
NYTimes.com

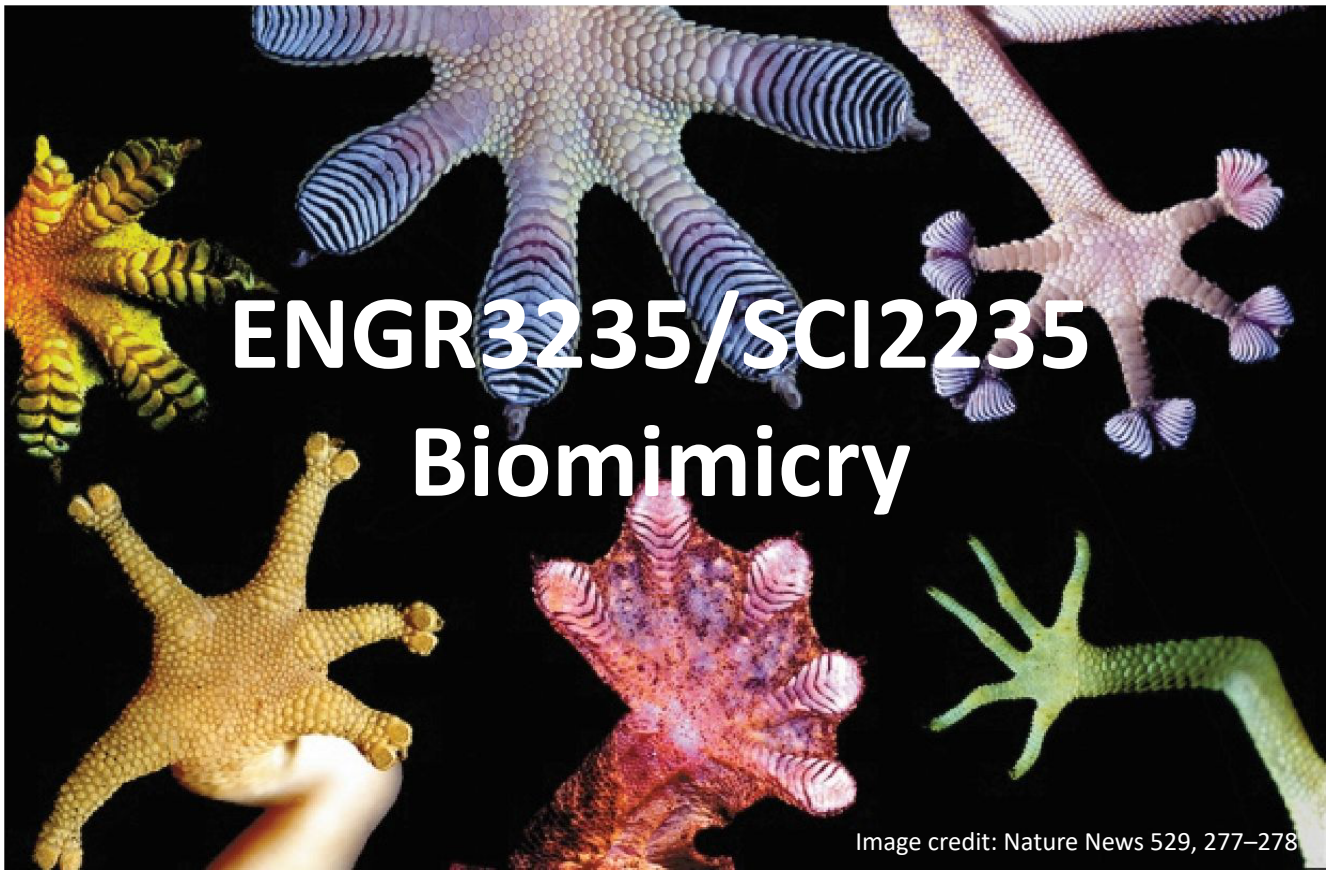
This course is an introduction to the tremendous diversity of the microbial world. The focus will be on the study of environmental bacteria and their metabolic, physiological and genetic diversity. Topics will include: bacterial growth, nutrient cycling, symbiosis, bioremediation, and molecular methods to work with bacteria. A significant portion of the course will involve exploration of the microbial world in the laboratory through individual and group projects. Students will gain experience with techniques to culture and study a variety of environmental bacteria and use bioinformatics tools for analysis of genomic data. In addition to developing technical skills, students will explore the applications of microbiology in business and entrepreneurship contexts.

Prerequisites: A foundation biology course

Contact: Jean Huang (jean.huang@olin.edu)

Spring 2025

"Nature as model, measure and mentor" -Janine Benyus



We can learn from nature! From studying a leaf to make a better solar cell to emulating natural processes to develop living buildings, the discipline of Biomimicry views nature as "model, measure and mentor" (Benyus, 1997). Spiders spin protein silk with the strength of steel yet much lighter all at ambient temperature and pressure. Cuttlefish change color to match their surroundings in milliseconds by contracting their chromatophores and even bioluminesce. In this course we will study wonders like these to appreciate the beauty and sophistication of life by investigating the biological mechanisms and functions of organisms as well as the dynamics of whole ecosystems. By examining biological systems at multiple scales, we can draw insights from understanding how they work. By collecting data, running experiments, creating models, or building prototypes, we can translate these insights into design ideas and practice. We will examine and discuss big ideas and thinking in biology and design and then synthesize and reflect on the intersection of these fields. Students will develop skills and insights through critical analysis of readings and the development of projects that draw on both fields. Biological systems have undergone 3.8 billion years of evolution, resulting in time-tested approaches to living on earth that are efficient and embody sustainability. By exploring the intersection of biology and design, we might learn to do the same.

Fulfills Design Depth or Intermediate Level Biology, Sustainability Concentration Elective
Co-requisites: CD, Principles of Modern Biology

Benjamin Linder (blinder@olin.edu), Jean Huang (jean.huang@olin.edu)

Environmental Analysis and Science (EAS)

Scott Hersey

Do you want to gain experience with community-engaged environmental analysis for impact? Are you interested in learning quantitative approaches to analyzing environmental systems? Curious how environmental data are collected and analyzed with lab instrumentation and software packages? Want to gain experience translating environmental insights into actionable steps for non-expert stakeholders like elected officials, advocacy groups, and residents? If you answered yes to any of those questions, you'll find a home in Environmental Analysis and Science (EAS)!

EAS At a Glance

- Choose 4 credits of: SCI, ENGR, **or** Intro to Sustainability;
- 3 main course sections: a) Air quality analysis and insights for community partners in Boston, b) Water quality analysis for Boston's Muddy River with partners CRWA, and c) Soil contamination analysis for partners in Boston;
- Activities include air quality data analysis and insight generation in R, water sample collection in the field, analysis of water samples in the laboratory, soil sample collection and laboratory analysis, written and oral communication of analysis insights to diverse audiences, and in-class data workshops;
- Meets twice per week for 100 minutes.

FAILURE!

Failure Analysis & Prevention

ENGR3820/SCI3420

Jon Stolk

Plan and implement hands-on investigations of failed components and products.

Learn theory on failure modes and mechanisms. Develop your analytical and design skills.

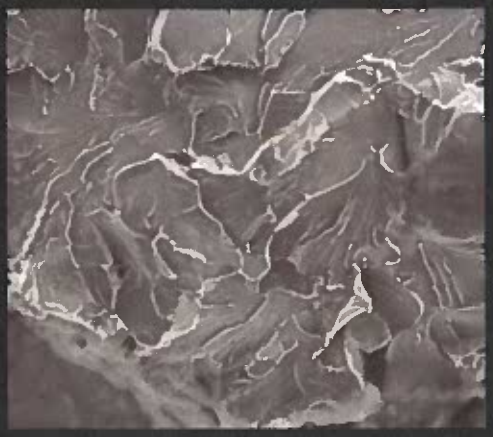


Image credits: Lenore Abbot (left), Allison Li, Joanna Sims, and Xander Hughes (middle and right)

Critically examine contextual factors of failure, like people, processes, policies, and standards.

Understand systemic failures by exploring historical and present-day failure case studies.

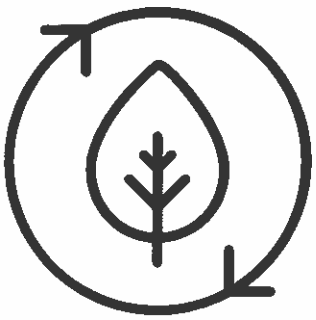
Image sources (left to right): The New York Times, The New York Times, Phil Degginger / Landsat / NASA

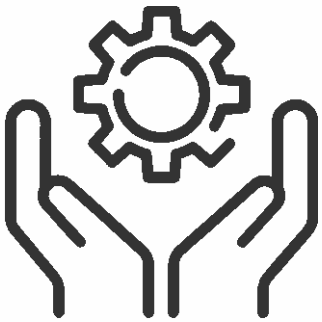
Sustainability Initiatives Research Collaboration (SIRC)

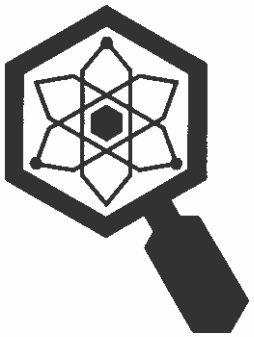
Spring 2025
4 Credits (Elective, credit area dependent on Spring '25 project type)
Pre-requisites: none

This new program pilot provides an industry project experience within a course and offers students from all grade years an opportunity to collaborate on real-world sustainability projects with industry partners and faculty. Through this hands-on experience, students will work in diverse teams and engage with industry liaisons to address challenges contributed by industry. Students will gain insights into problem solving for sustainability in a real-world context.

The subject of the project will be dependent on the industry partner, TBD for Spring 2025.







Contact:
Jean Huang (jean.huang@olin.edu), Lauren Palmer (lauren.palmer@olin.edu)

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