

EN1: Introduction to Engineering Section Descriptions

Fall 2020

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Tufts School of Engineering (SoE) *First Year Courses* Website: <https://sites.tufts.edu/soefirstyear/>

Overview

EN1 Introduction to Engineering: Introduction of various concepts in engineering. Emphasis on project work, engineering ethics, and engineering design process. Discipline topic areas vary each term. Limited to first-year students.

For Fall 2020, courses are **virtual**, **hybrid** or **in-person** in nature.

Please reach out to the individual instructors if you have questions regarding details of a particular section of EN1. Otherwise, please reach out to your assigned Tufts SoE Advisor for general academic advice.

EN1 Sections (Fall 2020)

Section 01: [Intro to Computational Design](#) (Soha Hassoun, CS)

Section 03: [Intro to Renewable Energy](#) (Thomas Vandervelde, ECE)

Section 04: [Simple Robotics](#) (Ethan Danahy, CS)

Section 05: [Innovation in Biomedical Eng](#) (David Kaplan and Fiorenzo Omenetto, BME)

Section 09: [Climate Change Engineering](#) (John Durant, CEE)

Section 10: [Coffee Engineering](#) (Kyongbum Lee and Matthew Panzer, CBE)

Section 11: [Civil Infrastructure](#) (Chris Swan, CEE)

Section 12: [Bridges for Resilient Cities](#) (Betsy Kirtland and Laurie Baise, CEE)

Section 13: [Impact of Self-Driving Cars](#) (Harold Miller-Jacobs and James Intriligator, ME/HF)

Section 14: [Inventing Smart Toys for Kids](#) (Briana Bouchard, ME)

Section 17: [Engineering in Crises](#) (Daniele Lantagne, CEE)

Section 24: [Engineering in the Kitchen](#) (Steven Bell, ECE)

Section Information:

- Department: Computer Science
- Lecture Class Number: #83811
- Lecture Times: Mo, We 1:30PM - 2:45PM (**Virtual**)
- Note: Must also sign up for one lab (#80187 or #80506)
 - Lab Option #1: Monday, 3:00PM - 4:15PM (**Virtual**)
 - Lab Option #2: Tuesday, 3:00PM - 4:15PM (**Virtual**)

Description:

With the availability of increased computing power, many engineering disciplines now rely on utilizing computation to explore different design options. We will learn how that is done: how to model a problem with math and how to use computers to optimize a product using that model. We'll optimize all sorts of products from different disciplines. We will learn to program in MATLAB, and then use it to learn fundamental concepts such as a solution space, design-decision variables, constraints, optimal points within the design space and searching a design space using efficient algorithms.



Soha Hassoun

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Soha Hassoun is a professor in, and a past chair of, the Department of Computer Science at Tufts University. She holds secondary appointments in the Department of Electrical and Computer Engineering and the Department of Chemical and Biological Engineering. Hassoun was an integrated circuit designer with Digital Equipment Corporation's Microprocessor Design Group, and worked as a consultant to several EDA companies, including Mentor Graphics and Carbon Design Systems. Her current research interests include developing algorithmic solutions to facilitate designing integrated circuits, and understanding the impact of new technologies such as double-gate devices, carbon nanotubes, and 3-D integration on design. Her other research includes computational methods for systems biology and metabolic engineering, including pathway analysis, modularity analysis, and pathway synthesis.

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #80180
- Lecture Times: Tu, Th 1:30PM - 2:45PM (**Hybrid**)

Description:

We will examine renewable energy generation technologies with a critical eye; including, the examination of the way the media portrays energy technologies. While going off the grid sounds like a great idea, it is a complex problem to be solved. Solar and wind energy sources require a lot of land; additionally, they are not constant with time, and efficient energy storage technology does not exist. We will explore the renewable energy technology of today as well as future prospects. We will look at the natural resource requirements of energy systems as well as their environmental and economic impacts. Labs will give the student a hands-on sense for the energy generation process and its complexity.



Tom Vandervelde

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Tom Vandervelde has a B.S. in both astronomy and physics from the University of Massachusetts-Amherst and an M.A. and Ph.D in physics from the University of Virginia. Vandervelde has extensive research experience in optoelectronics and photonics.

Section Information:

- Department: Computer Science
- Lecture Class Number: #80188
- Lecture Times: Tu, Th 12:00PM - 1:15PM (**In Person**)
- Note: Must also sign up for lab (Fr 12:00PM - 1:15PM)

Description:

Introduction to robot construction, programming, event-based programming, artificial intelligence, and elementary controls. Basic principles of robotics for students with minimal or no prior programming/building background. Hands-on projects emphasizing engineering design using a LEGO-based Robotics platform.



Ethan Danahy

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Ethan Danahy is a Research Assistant Professor at the Center for Engineering Education and Outreach (CEEEO) with secondary appointment in the Department of Computer Science at Tufts University. Having received his graduate degrees in Computer Science and Electrical Engineering from Tufts University, he continues research in the design, implementation, and evaluation of different educational technologies. Ranging from software and hardware to interfaces and environments, he explores how these tools can improve interactive educational pedagogies through supports aimed at learners in K-12 through university classrooms. With particular attention to engaging students in the STEAM content areas, he focuses his investigations on enhancing creativity and innovation, supporting better documentation, and encouraging collaborative learning.

Section Information:

- Department: Biomedical Engineering
- Lecture Class Number: #80185
- Lecture Times: Tu, Th 9:00AM - 10:15AM (**In Person**)

Description:

The course focuses on current topics in biomedical engineering related to the discipline, perspectives on technology impact in society, and concepts and problem-solving teamwork by the students. The goal is to utilize big picture themes to gain insight into the current state of technology related to human health and well-being in the future. Primary goals are 1) to expose students to science and technology involved in the field of biomedical engineering, 2) to look into the future with problem solving and impact on human health and society; and 3) to work in teams to challenge limitations and future opportunities empowered by the field of biomedical engineering.



David Kaplan
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Fiorenzo Omenetto
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David Kaplan is the chair of the Department of Biomedical Engineering and also holds faculty appointments in the School of Medicine, the School of Dental Medicine, the Department of Chemistry, and the Department of Chemical and Biological Engineering. His research focus is on biopolymer engineering to understand structure-function relationships, and studies related to self-assembly, biomaterials engineering, and functional tissue engineering/regenerative medicine.

Fiorenzo Omenetto is a professor of Biomedical Engineering at Tufts University and holds secondary appointments in the Department of Physics and the Department of Electrical Engineering. He has proposed and pioneered the use of silk as a material platform for advanced technology with uses in photonics, optoelectronics, and nanotechnology applications and is co-inventor on a number of disclosures on the subject.

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #80181
- Lecture Times: Mo, We 3:00PM - 4:15PM (**In Person**)

Description:

Climate change is one the great environmental challenges of our times. The central question is this: can we slow the rate of climate change enough to give emerging solutions a chance to be effective? This course examines the role of engineering and technology in both contributing to and mitigating climate change and its effects. Coverage will be given to fossil fuel combustion, energy consumption, greenhouse gas generation and accumulation in the atmosphere, alternative fuels, energy efficiency, carbon sequestration, climate geoengineering, sea level rise, coastal armoring and retreating as well as other topics. The goal of this course is to introduce the process of engineering design as applied to climate change – from problem definition to consideration of alternative solutions to the design and implementation of specific technologies. Broad exposure is given to the interdisciplinary nature of the problem and potential engineering solutions.



John Durant

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John Durant is an associate professor in the Department of Civil and Environmental Engineering at Tufts School of Engineering. He received his Ph.D. in civil and environmental engineering from MIT. John Durant's research interests include air pollution monitoring and modeling, effect-directed analysis of environmental samples, watershed-scale chemical fate and transport processes, and chemical exchange between surface waters and aquatic sediments.

Section Information:

- Department: Chemical and Biological Engineering
- Lecture Class Number: #80182
- Lecture Times: Tu, Th 1:30PM - 2:45PM (**Hybrid**)

Description:

What agricultural commodity is produced at a scale of over 20 billion pounds per year globally? Coffee beans! This course provides an introduction to several (bio)chemical engineering concepts, including: mass and energy balances, process flow diagrams, driving forces for molecular motion, and some organic/physical chemistry, all discussed in the context of coffee production and brewing. Additional topics include: coffee economics, caffeine biology and metabolism, data representation/statistics, and pressure-driven flow.



Kyongbum Lee

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Matthew Panzer

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Kyongbum Lee is the Department Chair of Chemical & Biological Engineering. His current research studies how the metabolites produced by gut bacteria impact human health.

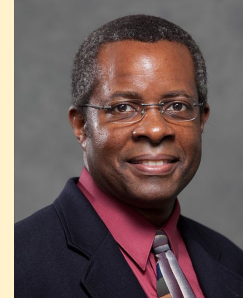
Matthew Panzer is an Associate Professor in the Department of Chemical & Biological Engineering. His current research is focused on the design of polymer-supported, ion-dense gel electrolytes for energy storage, sensing, and other applications.

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #80183
- Lecture Times: Mo, We 1:30PM - 2:45PM (**Hybrid**)

Description:

An introduction to civil infrastructure with a focus on its transportation, water, energy and waste management components. Both technical and professional aspects of these components will be explored. In addition, the “entrepreneurial mindset”, via elements of the Lean Start-up process, will be used to explore how innovations in civil infrastructure can be developed and implemented. This ‘mindset’ may provide a more effective alternative in conceptualizing infrastructure (re)development. Though technical content and entrepreneurship are emphasized, the course also explores ethical issues and broader impacts of civil infrastructure with an emphasis on the political and social justice aspects in current solutions.



Chris Swan

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Chris Swan is an associate professor in the Civil and Environmental Engineering (CEE) department and is currently Dean of Undergraduate Education in the School of Engineering. He also serves as the School of Engineering’s representative to the new Tufts University Cabinet on Diversity and Inclusion (TUCDI) and a senior fellow in Tisch College of Civic. Additionally, he has served as a lead instructor for NSF’s national I-Corps for Learning (I-Corps L) program, which explores the use of an ‘entrepreneurial mindset’ to examine the sustainability and scalability of innovations in engineering education. His current engineering education research efforts focus on evaluating the impact of service-based learning in engineering education. He also performs research on the development/implementation of reuse strategies for waste materials. Most notably, he has been involved in the development of synthetic lightweight aggregates (SLA), an innovative construction material that can be used in place of traditional sand and gravel.

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #80394
- Lecture Times: Tu, Th 6:00PM - 7:15PM (**In Person**)

Description:

We will use the semester to understand the interaction of bridge design for resilient cities. Bridges play a significant role in urban design as they connect populations and often provide a significant architectural contribution to the cityscape. As a major component of a transportation network, bridges also play an essential role in creating resilient cities and ensuring that transportation networks remain functional in an emergency. We will study bridges in three major cities to learn about engineering design, city planning, and natural hazards with a focus on the creation of resilient cities. Students will learn engineering design of bridges and will access and map geospatial terrains.



Betsy Kirtland

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Laurie Baise

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Betsy Kirtland is a Structural Engineer at Stantec on the Bridge Design Team in Boston. She is a part-time lecturer in the department of Civil and Environmental Engineering, teaching a class for freshman about the basics of bridge design and the importance of resilience in civil engineering.

Laurie Baise is a professor in and the chair of the Department of Civil and Environmental Engineering at Tufts School of Engineering. She is a member of the Geosystems Faculty, and lead investigator in the Geohazards Research Lab where her work addresses hazards such as earthquakes and extreme wind, and links predictive models with observational data. She is an expert in earthquake site response and regional seismic hazard mapping. Baise's recent research focuses on regional mapping for rapid response and loss estimation.

Section Information:

- Department: Mechanical Engineering/Human Factors
- Lecture Class Number: #83806
- Lecture Times: Tu, Th 1:30PM - 2:45PM (**Hybrid**)

Description:

There is no question about it – Self-Driving Cars will be here; the only dilemma is when! This class will examine all aspects of this coming revolution. We will address the questions of:

- What are the advantages and disadvantages of self-driving cars?
- What are the technologies that will enable this to happen?
- How are the engineering complexities being addressed?
- Who are the key players in the world?
- What impact will this revolution have on our way of life?
- What are the social, ethical, urban, environmental, and legal implications of this revolution?



Harold Miller-Jacobs

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James Intriligator

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Hal Miller-Jacobs has been a Human Factors Engineer for many decades, working on a variety of projects, including building the first infotainment system user interface for General Motors. On the adjunct faculty teaching in the Psychology Department at Tufts, he is driving his second Tesla and can't wait for full self-driving to become legal.

James Intriligator earned his Ph.D. in cognitive neuroscience from Harvard University and then did a postdoc in neurology. After five years running think-tanks and innovation centers, he returned to academia and merged his technology, business, and scientific expertise at Bangor University (Wales, UK) creating Europe's leading consumer psychology master's programs and co-developed several multidisciplinary design programs. He came to Tufts in 2016 to run the Tufts Human Factors Engineering program and enjoys creating psychologically informed human-machine systems.

Section Information:

- Department: Mechanical Engineering
- Lecture Class Number: #80524
- Lecture Times: Mo, We 12:00PM - 1:15PM (**Hybrid**)

Description:

We will spend the semester learning how to leverage the Internet of Things to create toys for kids. Our goal is to make sure all students leave the class understanding how to see the world through the eyes of children, be able to design something using smart technologies that children will find compelling, be able to build it and then understand how to commercialize it. We will also address ethical issues around toy design and highlight the different engineering disciplines required to successfully develop the toy.



Briana Bouchard

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Briana Bouchard is a part-time lecturer and full-time student advisor in the Department of Mechanical Engineering. She has a BS in Mechanical Engineering and an MS in Engineering Management both from Tufts. Her research interests include post-secondary engineering education, conceptual understanding in engineering, and incorporating professional engineering practice into the undergraduate learning environment.

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #83600
- Lecture Times: Mo, We 1:30PM - 2:45PM (**Hybrid**)

Description:

Emergencies - including national disasters, conflict, and outbreaks - are currently increasing worldwide. In this course, we will examine the role of engineering in 3-4 case study emergencies, potentially including the Haiti earthquake/cholera outbreak, the Fukushima earthquake/tsunami/nuclear disaster, hurricanes in the United States, the Deepwater Horizon Oil Spill, wildfires worldwide, and/or (pending student interest and comfort) the current COVID-19 pandemic. Each case study will begin with an introduction, then technical engineering concepts, then a culminating project or activity.



Daniele Lantagne
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Daniele Lantagne is a public health engineer. She began working in water, sanitation, and hygiene to reduce the burden of infectious disease in 2000, and continued working in this field at MIT, at the Centers for Disease Control and Prevention, and at Harvard's Center for International Development until she joined Tufts University as a Professor in 2012. Her main research interest is how to reduce the burden of infectious diseases by investigating and evaluating the efficacy and effectiveness of water, sanitation, and hygiene interventions.

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #83337
- Lecture Times: Mo, We 12:00PM - 1:15PM (**In Person**)

Description:

In this course, we will explore engineering through the lens of food and kitchen gadgets. During the semester, we will disassemble every electrified food-preparation device we can get our hands on, learn how they work, and use our newfound skills to build a few of our own. Along the way, you'll analyze and design basic electrical circuits, program microcontrollers to take measurements and respond to them, log data to answer questions about cooking, and connect the Things you build to the Internet. We'll also explore some of the complex social and ethical issues at the intersection of technology and food: does a cloud-connected refrigerator make us more efficient, or more lazy, or does it just result in more e-waste? And what responsibility do engineers have when working with something so deeply human as food?



Steven Bell

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Steven Bell is an Assistant Teaching Professor in Electrical and Computer Engineering. His research interests include camera systems, embedded systems, and tools for making hardware design more productive. He is also researching how students learn digital design, leading towards ways to make computer engineering more accessible and understandable in the classroom.