

EN1: Introduction to Engineering Section Descriptions

Fall 2021

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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 2021, Tufts courses are **in-person**, **hybrid**, or **virtual** 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 2021)

- Section 01:** [Intro to Renewable Energy](#) (Thomas Vandervelde, ECE)
- Section 02:** [Engineering in the Kitchen](#) (Steven Bell, ECE)
- Section 03:** [Electricity Inside You](#) (Joel Grodstein, ECE)
- Section 04:** [Climate Change Engineering](#) (John Durant, CEE)
- Section 05:** [Innovation in Biomedical Eng](#) (David Kaplan and Fiorenzo Omenetto, BME)
- Section 06:** [Bridges for Resilient Cities](#) (Betsy Kirtland and Laurie Baise, CEE)

- Section 08:** [Simple Robotics](#) (Ethan Danahy, CS)
- Section 10:** [Coffee Engineering](#) (Matthew Panzer, CBE)
- Section 13:** [Impact of Self-Driving Cars](#) (Harold Miller-Jacobs and James Intriligator, ME/HF)
- Section 15:** [Biomechanics](#) (Hoda Koushyar, Mechanical Engineering)
- Section 17:** [Engineering for the Customer](#) (Eli Cushner, Gordon Institute of Engineering Management)

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #83072
- Lecture Times: Tu, Th 1:30PM - 2:45PM (**Virtual**)

Description:

We will examine renewable energy generation technologies with a critical eye; including, the examination of the way the media portrays energy technologies. 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. 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. Labs will give the student a hands-on sense for the energy generation process and its complexity.



Tom Vandervelde

tvanderv@ece.tufts.edu

Tom Vandervelde is the Department Chair of Electrical and Computer Engineering and the Director of the Graduate Materials Science and Engineering Program, which is part of the Tufts Interdisciplinary Advanced Materials (TIAMAT) Center. He also holds secondary appointments in the Department of Mechanical Engineering and the Physics and Astronomy Department. His research group The Renewable Energy and Applied Photonics Laboratories (REAP Labs). His research focuses on how light interacts with matter, with an emphasis on new materials and devices for energy generation and waste energy harvesting.

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #83073
- Lecture Times: Tu, Th 4:30PM - 5:45PM (**In Person**)
- Section website: <http://www.ece.tufts.edu/en/1EK/>

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

steven.bell@tufts.edu

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.

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #83074
- Lecture Times: Mo, We 3:00PM - 4:15PM (**In Person**)
- Section website: <http://www.ece.tufts.edu/en/1EIY/>

Description:

Forget the Terminator – we ordinary humans are already electrically powered! In this course, we'll learn what bioelectricity is. We'll learn its applications to medicine, both today (pacemakers, electrical pain relief and more) and in the potential future (regenerative medicine). Mainly, we'll spend lots of time building and programming embedded-computing hardware that acts as bioelectrically-controlled prosthetics, cardiac monitors, and more.



Joel Grodstein

joel.grodstein@tufts.edu

Joel Grodstein has degrees in electrical engineering and computer science. He has spent almost 30 years working in the computer industry for Intel, HP, Compaq and Digital Equipment Corporation as a CPU designer, silicon debugger, and CAD-tool developer. He's now enjoying his second career teaching classes that cover computer architecture and design, VLSI, parallel and high-performance computer programming, and applications of computing to biology.

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #83838
- 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

john.durant@tufts.edu

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: Biomedical Engineering
- Lecture Class Number: #83754
- 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
david.kaplan@tufts.edu



Fiorenzo Omenetto
fiorenzo.omenetto@tufts.edu

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: #83839
- 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

betsy.kirtland@stantec.com



Laurie Baise

laurie.baise@tufts.edu

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: Computer Science
- Lecture Class Number: #83860
- Lecture Times: Mo, We 1:30PM - 2:45PM (**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

ethan.danahy@tufts.edu

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: Chemical and Biological Engineering
- Lecture Class Number: #84174
- Lecture Times: Tu, Th 1:30PM - 2:45PM (**In-Person**)
- Must sign up for one of the following labs:
 - Lab #84744: Fr 1:30PM - 2:45PM
 - Lab #84745: Fr 3:00PM - 4:35PM

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.



Matthew Panzer

matthew.panzer@tufts.edu

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: Mechanical Engineering/Human Factors
- Lecture Class Number: #84006
- Lecture Times: Tu, Th 3:00PM - 4:15PM (**In Person**)

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

harold.miller-jacobs@tufts.edu



James Intriligator

james.intriligator@tufts.edu

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: #84007
- Lecture Times: Mo, We 1:30PM - 2:45PM (**Hybrid**)

Description:

We start with an introduction to skeletal and muscular anatomy of human body. We will then overview tools and techniques to evaluate human body performance through in-class hands-on experiments including measurement of muscle strength, muscle fatigue, balance, and analyzing movements through motion capture. We will also discuss applications of biomechanics in sports, rehabilitation, and assistive technology and do a group project to design, build, and evaluate an assistive device.



Hoda Koushyar

hoda.koushyar@tufts.edu

Hoda Koushyar is an Assistant Teaching Professor within the Department of Mechanical Engineering. Her research interests are in biomechanics, applied mechanics, materials characterization, and engineering education. Dr. Koushyar has been an instructor at Tufts since 2017 and has taught thermodynamics and biomechanics courses.

Section Information:

- Department: Gordon Institute of Engineering Management
- Lecture Class Number: #84746
- Lecture Times: Tu 6:00PM - 9:00PM (**In Person**)

Description:

What do Amazon, Broadway, and Dunkin' Donuts have in common? They deliver great customer experiences. These experiences are anything but random; they are carefully designed and engineered. Through team projects, class discussions, and guest speakers, we will analyze physical products, user-interfaces, service experiences, and the leadership skills needed to bring it all together. You will leave this course with a mindset and toolset to focus on the customer as you continue your engineering journey at Tufts.



Eli Cushner

eli.cushner@tufts.edu

Eli Cushner brings his experience as a Manager of Customer Success at Paytronix Systems to the classroom. Prior to his role in management, he was a technical project manager building innovative marketing programs for the restaurant industry. Eli completed his undergraduate studies at Tufts University in Engineering Psychology, Entrepreneurial Leadership, and Engineering Management. He is also a graduate of the Tufts Gordon Institute's Master of Science in Engineering Management (MSEM) program. In addition to teaching *EN1: Engineering the Customer Experience*, he also teaches *EM153: Management of Innovation* through the Tufts Gordon Institute.