Tufts UNIVERSITY | School of Engineering

EN1: Applications in Engineering

Tufts Intro to Engineering Section Descriptions

Fall 2022

Document last updated: August 18th, 2022

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

Tufts UNIVERSITY | School of Engineering

Overview

Applications in Engineering (EN1): 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.

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 Academic Advisor for general academic advice.

Tufts UNIVERSITY | School of Engineering

Registration

Notes on Registration:

- Tufts Engineering students register first, and then A&S students register second. Every section of EN1 has seats specifically reserved for A&S students. After A&S registration, if they have not been filled, they will open up and either (a) automatically filled by the waitlist or (b) become open for any/all students.
- If you are on the waitlist for an EN1 section, you can still sign up for another (open) section, and be automatically swapped if you get off the waitlist
  - This is called a ***"Future Swap" (Add then Drop)*** and requires careful implementation in SIS
  - **Follow these instructions to do this properly.** A mistake will lose your spot on the waitlist.

Tufts UNIVERSITY | School of Engineering

EN1 Sections (Fall 2022)

Section 01: Intro to Renewable Energy (Thomas Vandervelde, ECE)

Section 02: Music & Art of Engineering (Jeffrey Hopwood, ECE)

Section 03: Engineering for the Customer (Eli Cushner, Gordon Institute of Engineering Management)

Section 04: The Craft of Computer Science Research (Soha Hassoun, CS)

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

Section 07: Remote Exploration with Roomba (Chris Rogers, ME)

Section 08: Simple Robotics (Ethan Danahy, CS)

Section 09: Community-Centered Engineering (Greses Pérez, CEE)

Section 10: Engineering in the Kitchen (Steven Bell, ECE)

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

Section 14: Electricity Inside You (Joel Grodstein, ECE)

Section 15: Sci-Fi Bioengineering (Nisha Iyer, BME)

Section 16: Bridges for Resilient Cities (Betsy Kirtland and Laurie Baise, CEE)

Section 17: Frontiers in Reproductive Health Engineering (Juan Gnecco, BME)

Section 01: Intro to Renewable Energy

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #83110
- Lecture Times: Tu, Th 1:30PM - 2:45PM

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 02: Music & Art of Engineering

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #83111
- Lecture Times: Tu, Th, Fr 12:00PM - 1:15PM

Description:

This course is a hands-on introduction to the fields of electrical and computer engineering. Because many engineers, mathematicians, and scientists are musicians, it makes sense to use music as the context for understanding the science of sound, electronics, and computers. We will study how electrical signals are used to represent sounds, and how these signals can be created and modified using both electronic circuits and computers. In the first half of the course, students will learn to design circuits and then use electronic instrumentation to probe how these circuits work. In the second half of the course, we will use computers and MATLAB to synthesize and modify sound. At the end of the course, groups of students will apply their newly acquired knowledge to design and build a musical project.

Jeffrey Hopwood
jeffrey.hopwood@tufts.edu

Jeffrey Hopwood has worked primarily in the fields of plasma processing and plasma source design. His current research interests include microplasma-based environmental sensors and novel plasma processes for the fabrication of nanoscale devices. Other research interests are plasma etching and deposition processes for integrated circuit fabrication, ionized physical vapor deposition (I-PVD), and plasma deposition of super-hard coatings.

Section 03: Engineering for the Customer

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Gordon Institute of Engineering Management
- Lecture Class Number: #84269
- Lecture Times: Tu 6:00PM - 9:00PM

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.

Section 04: The Craft of Computer Science Research

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Computer Science
- Lecture Class Number: #83538
- Lecture Times: Mo, We 3:00PM - 4:15PM

Description:

While it might be obvious why we need research in biology or history, Computer Science research is necessary to reinvent the field and to drive discoveries across many disciplines. This course will teach you the foundations of research. Students will work with a faculty mentor and a student group on a research project. Research topics include machine learning, computer security, quantum computing, human-robotics interaction, computational biology, computational geometry, and others. The course will cover topics including identifying and formulating research problems, reading and evaluating research papers, literature searching, self-guided learning, designing research studies, and data analysis. Students will practice working in a team, goal setting, activity logging, and communicating with others. This is a non-coding class. No prior coding or CS experience is required. Student groups are expected to develop a research proposal by the end of the semester and to be well-prepared to participate in future Computer Science research experiences.

Soha Hassoun
soha@cs.tufts.edu

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 05: Innovation in Biomedical Eng

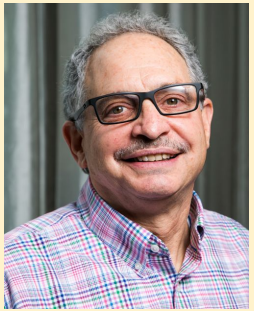
Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Biomedical Engineering
- Lecture Class Number: #83515
- Lecture Times: Tu, Th 9:00AM - 10:15AM

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 07: Remote Exploration with Roomba

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Mechanical Engineering
- Lecture Class Number: #83488
- Lecture Times: Mo, We 10:30AM - 11:45AM

Description:

Using the iRobot Create 3 robot platform, we will build and program robots to do things like dance, soccer penalty kicks, remotely controlled exploration, and a robotic jousting tournament. Along the way, students will learn asynchronous coding (in Python and ROS) as well as fabrication techniques such as 3D printing, laser cutting, and water jet cutting. Through building crazy robots, students will get an overview of engineering: the different disciplines, the role of math and science, different educational pathways, etc. Weekly robotics challenges will highlight student ingenuity, creativity, and innovation.

Chris Rogers
chris.rogers@tufts.edu

Chris Rogers' current research work falls into four areas: (1) manufacture of musical instruments, (2) engineering education, (3) educational robotics, and (4) education outreach. The first is mainly aimed at optimizing existing manufacturing processes and the other three look at ways of understanding how students think and then using that knowledge to develop new educational technologies and work with teachers and schools in the use of these technologies.

Section 08: Simple Robotics

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Computer Science
- Lecture Class Number: #83546
- Lecture Times: Mo, We 10:30AM - 11:45AM
- Lab Time: Fr 10:30AM - 11:45AM

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 or 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 (CEEO) 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 09: Community-Centered Engineering

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #83646
- Lecture Times: Mo, We 3:00PM - 4:15PM

Description:

As a result of a lack of diversity in engineering, too many solutions inadvertently discriminate against people with real-life consequences for society. This course offers an experiential opportunity to learn with communities that engineering starts and ends with people. Along the way, students will learn different approaches to understand individuals and technologies. At the end of the course, students will use their knowledge to redesign social spaces. No prior experience is necessary. Students will develop an understanding of people from different backgrounds and how they interact with engineering groups. These experiences will prepare students with useful skills for future projects and research experiences. In learning about who we are as engineers and the communities we interact with, students will explore questions about what it means to be an engineer and who can become one.

Greses Pérez
greses.perez@tufts.edu

Greses Pérez is an engineer, learning scientist and educator. Her scholarship specializes in the interdisciplinary study of language and cognition for students who experience a cultural and linguistic mismatch between the practices of their communities and those in engineering and science. Her mission is to expand who is heard and can contribute to the disciplines as society demands professionals with backgrounds as diverse as the challenges we face.

Section 10: Engineering in the Kitchen

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #84854
- Lecture Times: Mo, We 3:00PM - 4:15PM
- 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 13: Impact of Self-Driving Cars

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Mechanical Engineering/Human Factors
- Lecture Class Number: #83487
- Lecture Times: Tu, Th 3:00PM - 4:15PM

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 14: Electricity Inside You

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #85185
- Lecture Times: Mo, We 4:30PM - 5:45PM
- 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 15: Sci-Fi Bioengineering

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Biomedical Engineering
- Lecture Class Number: #85315
- Lecture Times: Mo, We 3:00PM - 4:15PM

Description:

Where does science fiction meet biological reality? Using classic and contemporary sci-fi films as a framework for inspiration and discussion, this course will survey the practicalities of once imaginary technologies including gene editing, chimeric animal research, artificial organs, rapid vaccines, neural interfaces, and more. As we dissect fact from fiction, students will grapple with global and interstellar bioengineering challenges, regulations, and ethics as they exist now and may exist in the near future.

Nisha Iyer
nisha.iyer@tufts.edu

Nisha Iyer's research interests are at the intersection of developmental biology and regenerative medicine, using stem cells to understand and advance neural repair. She has developed clinically translatable methods to derive regionally and phenotypically specified hindbrain, spinal cord, and peripheral tissues from human pluripotent stem cells. Her lab focuses on using human pluripotent stem cells to determine how regional and phenotypic specificity drives neural circuit formation, degeneration, and regeneration in the spinal cord.

Section 16: Bridges for Resilient Cities

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Civil and Environmental Engineering
- Lecture Class Number: #85335
- Lecture Times: Tu, Th 6:00PM - 7:15PM

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

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.

Section 17: Frontiers in Reproductive Health Engineering

Tufts UNIVERSITY | School of Engineering

Section Information:

- Department: Biomedical Engineering
- Lecture Class Number: #85336
- Lecture Times: Tu, Th 3:00PM - 4:15PM

Description:

Reproductive tissues are some of the most dynamic, multifactorial, and complex systems of the human body and, as such, remain some of the most poorly understood. *Frontiers in Reproductive Health Engineering* is an introductory course that explores how big picture themes in the discipline of biomedical engineering (BME) can help to demystify, destigmatize and advance the way we understand women's reproductive health and its diseases. The goal of the course is to expose first year students to both the basic principles of engineering and the fundamentals of the reproductive biology through a series of didactic lectures, group discussions, demos and invited guest speakers that span the current state of technology, the existing needs, and the future of reproductive health.

Juan Gnecco
juan.gnecco@tufts.edu

Juan Gnecco's research vision lies at the interface of reproductive biology and tissue engineering to understand the immune-endocrine mechanisms driving both reproductive physiology and disease pathogenesis. He developed the first microphysiological systems (MPS) model of the perivascular endometrium and deployed this model to illuminate the inflammatory effects exerted by environmental toxicants on the female reproductive tract.

Tufts UNIVERSITY | School of Engineering

First-Year Engineering Design Challenge

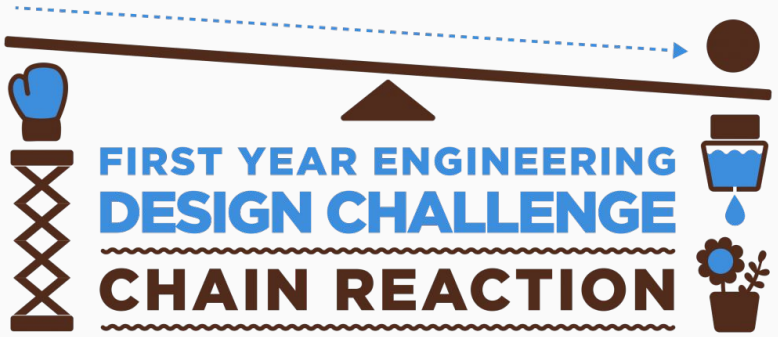
Class of 2026!

Every fall* the first-year students get together and work collaboratively to complete a *"First Year Engineering Design Challenge."* For the **Class of 2026** we will be creating a giant

CHAIN REACTION

on the afternoon of Saturday, September 17th

Save the date and sign up at the link below!



Saturday, September 17th from 1pm to 5pm

For more information: https://sites.tufts.edu/soefirstyear/information/information-for-students/design-challenge/

*ok, so technically Fall 2022 is the very first fall we've ever done this, but that means ***YOU*** can be there for the ***start*** of this yearly tradition!