EN1: Applications in Engineering
Tufts Intro to Engineering Section Descriptions

Fall 2023

Document last updated: August 21st, 2023

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

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.

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.

EN1 Sections (Fall 2023)

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

Section 02: Coffee Engineering (Matthew Panzer and Kyongbum Lee, ChemE)

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: Critical Thinking in Engineering (and beyond) (Mark Kachanov, 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: Enhancing Human Movement Capabilities (Felix Huang, ME)

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

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

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

Section 18: Exploring Computer Science (Diane Souvaine, CS)

Section Information:
- Department: Electrical and Computer Engineering
- Lecture Class Number: #80473
- 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 Information:
- Department: Chemical and Biological Engineering
- Lecture Class Number: #84020
- Lecture Times: Tu, Th 1:30PM - 2:45PM
- Required Lab (#85139): Fr 1:30PM - 2:45PM

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

Kyongbum Lee
kyongbum.lee@tufts.edu

Matthew Panzer is a 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.

Kyongbum Lee is the dean of Tufts University School of Engineering and professor in the Department of Chemical and Biological Engineering. His current research studies how the metabolites produced by gut bacteria impact human health.

Tufts | School of
UNIVERSITY | Engineering

Section Information:
- Department: Gordon Institute of Engineering Management
- Lecture Class Number: #80620
- 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 is the Senior Manager of Knowledge Management & Learning at Paytronix Systems. He brings his experience in leadership, customer experience, and technical project management to the classroom. Eli completed his undergraduate studies at Tufts University in Human Factors Engineering, Entrepreneurship, and Engineering Management. Eli received his Master of Science in Engineering Management (MSEM) from the Tufts Gordon Institute. Eli teaches "Management of Innovation" and "Engineering for the Customer" through the Tufts Gordon Institute. In his spare time, Eli is a sleight-of-hand magician and incorporates magic into class each week.

School of Engineering

Tufts UNIVERSITY

Section Information:
- Department: Computer Science
- Lecture Class Number: #80584
- 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.

Tufts UNIVERSITY | School of Engineering

Section Information:
- Department: Mechanical Engineering
- Lecture Class Number: #83516
- Lecture Times: Mo, We 10:30AM - 11:45AM

Description:

The ability to critically examine issues is important in engineering practice – particularly when controversial issues are involved (such as alternative energy sources, etc.). Its importance stretches beyond engineering: in a democratic society, the opinions of people affect the decision-making process, and these opinions should be based on critical examination of various claims and statements. The course will involve projects whereby students will be required to examine various issues, using internet sources, and make convincing brief presentations.

Mark Kachanov
mark.kachanov@tufts.edu

Mark Kachanov is a professor in Mechanical Engineering whose research is focused on micromechanics of materials and its applications to various materials systems, as well as on piezoelectrics. Much of his work is carried out in cooperation with industry. Broad research topics include the micromechanics of materials; microstructure-property connections; applications to coatings, geo-materials, and bone; and piezoelectric and nano-electromechanics.

Tufts | School of Engineering
UNIVERSITY

Section Information:
- Department: Computer Science
- Lecture Class Number: #80585
- Lecture Times: Mo, We 10:30AM - 11:45AM
- Required Lab (#80619): 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 Associate 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 Information:
- Department: Civil and Environmental Engineering
- Lecture Class Number: #80597
- Lecture Times: Mo, We 3:00PM - 4:15PM

Description:

The goal of engineering is to develop solutions for a diverse population and to do so engineers need to meaningfully engage with the communities they serve. This course offers an experiential opportunity to learn with communities about how engineering starts and ends with people. Students in this course will partner with local K-12 students to engage in engineering design with cross-generational teammates and explore mentorship opportunities. Along the way, students will learn different approaches to understand people and technologies. Through this course, students will use their knowledge to co-design community-relevant engineering activities and products for young students, including games, STEM activities, and other products that focus on the community. Students will develop an understanding of people from different backgrounds and how they interact with engineering design activities. These experiences will prepare them with useful skills for future projects and research experiences, such as working with external partners and transforming ideas into solutions and products through rapid iteration. 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. No prior experience is necessary.

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.

Tufts | School of
UNIVERSITY | Engineering

Section Information:

- Department: Electrical and Computer Engineering
- Lecture Class Number: #80633
- 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.

Tufts UNIVERSITY | School of Engineering

Section Information:
- Department: Mechanical Engineering/Human Factors
- Lecture Class Number: #80570
- Lecture Times: Tu, Th 12:00PM - 1:15PM

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?

We will examine these topics through lectures, guest speakers, and student presentations. The aim of the course is to not only examine the engineering principles involved in self-driving cars but to also examine the societal implications as we move forward with this technology.

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: #85054
- Lecture Times: Tu, Th 12:00PM - 1:15PM

Description:

This course examines how wearable technology and customized game environments can be designed to improve targeted aspects of human movement skill. Fundamental engineering topics, including dynamics simulation, feedback control, biomechanical models, robot kinematics, are introduced. A final team project features hands-on skills in using sensors and actuators, coding for experiments, and visualizing real-time data.

Felix Huang
felix.huang@tufts.edu

Felix Huang is a lecturer in the Mechanical Engineering Department at Tufts University. His major research interests include human motor control, robotic rehabilitation for stroke survivors, expert skill training for surgery, and control design of haptic devices. Prior to Tufts, he was previously a research scientist and research assistant professor at the Shirley Ryan AbilityLab (formerly the Rehabilitation Institute of Chicago) and at Northwestern University's Department of Physical Medicine and Rehabilitation.

Section Information:
- Department: Biomedical Engineering
- Lecture Class Number: #80658
- Lecture Times: Tu, Th 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 Information:
- Department: Civil and Environmental Engineering
- Lecture Class Number: #80660
- 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 the basics of bridge engineering, will be introduced to geospatial mapping, and will learn about what makes communities resilient.

Betsy Kirtland
betsy.kirtland@stantec.com

Betsy Kirtland, PE is an award winning 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.

Tufts UNIVERSITY | School of Engineering

Section Information:
- Department: Biomedical Engineering
- Lecture Class Number: #80661
- 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

Section Information:
- Department: Computer Science
- Lecture Class Number: #85518
- Lecture Times: Mo, We 3:00PM - 4:15PM

Description:

Basic principles of computer science for students with minimal or no prior programming background. Fundamentals of design, coding, and testing computer programs. Fundamental algorithms for sorting and searching. Programming projects employ and demonstrate common algorithms. Projects analyze and visualize data from real applications. This sampling of various topics will give the student a taste of not only what constitutes computer science, but also a deeper understanding of mankind's most powerful tool. The course will prepare the student to take CS 11 in a subsequent semester, if so desired. ***Note:*** *Section 18 should **NOT** be taken in the same semester as CS 11.*

Diane Souvaine
diane.souvaine@tufts.ed

Diane Souvaine's research in computer science spans the fields of computational geometry, design and analysis of algorithms, and computational complexity. In addition to being a professor in Computer Science (with secondary appointment in Mathematics), Dr. Souvaine has served as Vice Provost for Research, Senior Advisor to the Provost, and Chair of the Department of Computer Science at Tufts. Dr. Souvaine is dedicated to increasing diversity and advancing women and underrepresented groups in STEM and works to enhance pre-college education in mathematics and computational thinking.

Visit the Tufts SoE First Year Website: https://sites.tufts.edu/soefirstyear/

Visit the Tufts course listing at SIS: https://go.tufts.edu/sis

Visit the School of Engineering and individual department webpages:

https://engineering.tufts.edu/

Reach out to members of the SoE Undergraduate Advising Teams:

https://go.tufts.edu/EngineeringAdvising

Check out the Engineering Degree Sheets for different engineering majors:

https://go.tufts.edu/EngineeringDegrees