ICE-T Modules offered Fall 2020

10.492A Electrochemical Engineering, MWF10-11 (Virtual), Fikile Brushett, first half of term

10.492A is a half-semester-long Integrated Chemical Engineering course, where students are exposed to a particular topic within the broad realm of chemical engineering. This course provides an introduction to electrochemical engineering with a focus on highlighting the connection to the chemical engineering discipline and exploring the unique aspects of electrochemical processes. Electrochemical technologies are an integral part of modern life. Methods based on electrochemical phenomena underlie sensors, energy storage and conversion, and microfabrication processes. Moreover, electricity can be used to drive the clean production of chemical and remediation of environmental pollutants. Though chemical engineers have an important role to play in the field, undergraduates are not typically exposed to electrochemistry. Thus, our aim is to provide an introduction to the fundamental principles, to demystify existing electrochemical systems, and, hopefully, to inspire ideas for future products and processes.

10.492B Process Intensification MWF10-11 (Virtual), Klavs Jensen, second half of term

Process intensification invokes new reaction techniques and equipment to improve chemical processes by miniaturizing, combining, controlling, and/or enhancing the underlying chemical and physical transport processes. The ultimate goal of process intensification is achieving higher efficiency, reduced energy consumption, less waste, safer operation, and long-term sustainability. This class explores the principles of process intensification through lectures, demonstrations, homework, and projects based on concepts introduced in transport phenomena (10.301/2), thermodynamics (10.213), kinetics, and reaction engineering (10.37). The current transition in pharmaceutical manufacturing from batch to continuous flow serves one of several examples of process intensification. Microwave, electrochemical, and photochemical reaction processes illustrate alternative, intensified approaches to drive chemical reactions instead of by conventional heating. Membrane reactors exemplify combined reaction and separation unit operations. 3D printing and other modern fabrication techniques serve to realize new, efficient processing equipment. Integration, automation, control and optimization form important elements in achieving further process intensification.

10.01 Ethics for Engineers
M3-5 (Virtual), Doug Lauffenburger, Peter Hanson (BioTech focus)
T3-5 (Virtual), Doug Lauffenburger, Peter Hansen (AI focus)
W3-5 (seniors only, in person, room TBD), Kathryn Hansen
W7-9 (Virtual), Peter Hansen

Explores the ethical principles by which an engineer ought to be guided. Integrates foundational texts in ethics with case studies illustrating ethical problems arising in the practice of engineering. Readings from classic sources including Aristotle, Kant, Locke, Bacon, Franklin, Tocqueville, Arendt and King. Case studies include articles and films that address engineering disasters, safety, biotechnology, the internet and AI, and the ultimate scope and aims of engineering. Different sections may focus on themes, such as AI or biotechnology. Students taking independent inquiry version 6.9041 will expand the scope of their term project. Students taking 20.005 focus their term project on a problem in biological engineering in which there are intertwined ethical and technical issues. In person not required. Limited to 18 per section.