ICE-T Modules 2022-2023

SPRING 2023

10.494A Design of new processes for reducing GHG emissions in the energy sector, MWF10-11, 66-168, Prof. William H. Green, first half of term

Currently the transportation fuel sector is a major source of greenhouse gas emissions, both in the fuel production process (and ancillary processes handling or valorizing byproducts) as well as in direct fuel use by consumers, and the relative importance of this sector to global GHG emissions is expected to increase over the next 20 years. There is therefore great interest in reducing the greenhouse gas emissions associated with fuel production. This half-semester subject will give the students experience designing a new chemical engineering process to reduce GHG emissions from this sector, considering a wide range of technical, practical, economic, ethical, environmental, and societal-impact factors. While most of this subject will be focused on a design project done by a student team, there will also be some lectures and homework focused on specific issues, to help prepare the students to tackle this challenging design problem. Prior experience with ASPEN is helpful for quantitatively evaluating proposed designs.

10.494B Therapeutic Nanoparticle Manufacturing, MWF11-12, 66-168, Prof. Daniel G. Anderson, second half of term

Lipid nanoparticles are poised to revolutionize the treatment of genetic disease by enabling the therapeutic delivery of nucleic acids that can turn your genes off, turn them on, or even permanently and specifically edit your genome. This class will provide an over view of lipid nanoparticles and drug delivery including what nanoparticles are made of, how they will be used, and in particular how they are made and analyzed. Projects will focus on the application of chemical engineering principles to design a continuous nanoparticle formulation process for pharmaceutical scale production. This will include examination of small-scale nanoparticle production procedures based on microfluidics, hands-on construction of nanoparticle formulation chips, and a study of how these devices might be adjusted to meet the needs of commercial-scale production.

10.01 Ethics for Engineers (full term)
M3-5, 66-156, Peter Hansen
M3-5, 66-148, Prof. Doug Lauffenburger, Kathryn Hansen
T3-5, 66-148, Peter Hansen
W7-9, 66-144, Peter Hansen

Explores how to be an ethical engineer. Students examine engineering case studies along with foundational ethical readings, and discuss which ethical approaches are best and how to apply them as engineers. Topics include justice, rights, cost-benefit analysis, safety, bias, genetic engineering, climate change, and the promise and peril of AI. Discussion-based. One section focuses on Computer Science case studies, one section on Bioengineering, and other sections cover engineering topics more broadly. Limited to 18 per section.