ABE/EEE 591
Principles of Sustainable Biomanufacturing
Fall 2023
Lecture: MW 3:30 PM – 4:45 PM

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Future manufacturing demands improving manufacturing practices to meet the goals of sustainable development including responsible resource consumption, reducing overall emissions, creating zero waste systems etc. There is a significant growth in biobased manufacturing that focuses on using renewable resources, biological processes, a combination of biochemical pathways and modular processes to support responsible manufacturing. Biomanufacturing ranges from biochemicals, bioproducts, pharmaceuticals etc, thus covering a range of manufacturing sectors that are necessary to build a sustainable biobased economy.

This course is designed to introduce principles of sustainability science specifically applicable to sustainable manufacturing focusing on biomanufacturing. Emphasis will be on learning fundamentals of sustainability science and engineering, industrial ecology principles, thermodynamics for resource management, computational methods and modeling techniques, circular economy etc. widely used in sustainability assessment of industrial systems and integrating engineering design principles for sustainable design. Introduction to basic biomanufacturing practices and emerging trends will also be covered. Computational Lab training to use the methods in analysis and design of manufacturing systems will be given.

Successful completion of the course will enable students to :

1. Understand and implement sustainability science and industrial ecology principles for manufacturing systems at multiple scales.
2. Perform quantitative sustainability assessment of manufacturing across sectors using different sustainability metrics.
3. Model basic biomanufacturing systems to perform simulations for scenarios of different manufacturing design.
4. Apply the basic sustainable design principles for design of sustainable biomanufacturing systems.

Textbook and Readings: Selected readings will be provided from literature and different textbook chapters as relevant for the course. As this is an interdisciplinary course, there will be reading from wide variety of topics including manufacturing systems, energy systems, macroeconomics, biology and ecology.

Recommended Pre-requisites: Basic understanding of chemical and biological manufacturing processes, thermodynamics, basic linear algebra, programming knowledge (Python/Matlab). Senior UG/Graduate level.