CENG 150S Engineering Improv:
An introduction to engineering analysis.

Classroom: ML 107
Class schedule: MWF 9:00-11:15am
Instructor: Michael Loewenberg
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Description:
Mathematical modeling is not a scripted procedure. Models are constrained by physical principles, including conservation laws and experimental observations but this does not provide a closed description. There is a lot more art in mathematical modeling than is commonly acknowledged and improvisation plays a significant role. The artistic aspects are important and intellectually engaging because they often lead to a deeper understanding.

This course provides a general introduction to engineering analysis and to chemical engineering principles. Material will include the derivation of governing equations from first principles and the analysis of these equations, including underlying assumptions, degrees of freedom, dimensional analysis, scaling arguments, and approximation techniques. The goal of this course is to obtain the necessary skills for improvising mathematical models for a broad range of problems that arise in engineering, science and everyday life. Students from all majors are encouraged to take this course.

Prerequisite: Math 112

Text:
Chemical Engineering, An Introduction,
Morton M. Denn, Cambridge.
ISBN 9781107669376.
https://dl.icdst.org/pdfs/files1/ae44fd68aa54af0e29f1112974fd0522.pdf

Exams and homework

4 non-cumulative tests¹, 20% each
weekly homework assignments, 20%

¹ Test problems will be drawn from weekly problem sets
Topics

1. Mass conservation; constitutive equations.
2. Dimensionless variables; characteristic scales.
3. First-order systems.
4. Degrees of Freedom.
5. Species conservation; well-mixed systems.
6. Stagewise processes; recycle streams.
7. Species conservation with sources; chemical reactions, reactors.
9. Thermodynamics; structure and theory, possible and impossible processes.
10. Distributed parameter problems; mass, energy, and momentum fluxes.
11. Conservation equations; boundary conditions.
12. Multivariable problems; Dimensionless parameters.