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. High school and college students with all interests and majors are encouraged to take this course.

Prerequisite:

High school level differential and integral calculus

Text:

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

Chemical Engineering Design and Analysis, An Introduction,
T. Michael Duncan & Jeffrey A. Reimer, Cambridge.
ISBN 9780511803352

Exams and homework

4 non-cumulative tests[1], 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. Species conservation; well-mixed systems.
4. Stagewise processes; recycle streams.
5. Species conservation with sources; chemical kinetics, reactors.
6. Energy conservation. Heat exhangers.
7. Thermodynamics; structure and theory.
8. Heat engines, refrigerators and heat pumps.
9. Dimensional analysis; scale-up.
10. Transport Phenomena: heat conduction, reaction and diffusion, fluid flow.