

EngrI 1120 - Introduction to Chemical Engineering

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Credit: 3 hours

Catalogue Description:

An overview of the chemical and biomolecular engineering profession by learning the basic tools of engineering design and analysis: problem formulation, material balances, and optimization methods. Specific tools include dimensional analysis, empirical analysis by graphics, degree-of-freedom analysis, material balance calculations, mathematical modeling and safety assessment.

Required or elective: Common-curriculum course: Elective

Prerequisites/Co-requisites: None

Time and Location: Lecture: T/Th 9:05-9:55am, 245 Olin Hall
Discussion section: T/W 2:30-4:25pm, 245/218 Olin Hall

Suggested Textbooks:

1. Chemical and Bioprocess Engineering by *Ricardo Simpson & Sudhir K. Sastry*
2. Elementary Principles of Chemical Processes by *Richard M. Felder & Ronald W. Rousseau*

Course Objectives:

To introduce students to the chemical and biomolecular engineering profession by teaching the basic principles and tools of problem formulation and analysis, material balance solutions, and optimization and decision making. The secondary goal is to help students determine if chemical engineering is their career path, and to introduce them to other aspects of chemical engineering by giving broader and more representative examples. A variety of examples are drawn from biochemical processing, drug formulation strategies, and traditional oil and gas operations for homeworks, quizzes and prelims.

Topics Covered:

Section 1:

Units conversions and dimensionless analysis in process engineering
A brief introduction to thermodynamics, transport phenomena and dimensionless numbers
Data processing, analysis and method of least squares

Section 2:

General concepts of material balance
Material balances on non-reacting systems at steady state
Flowchart scaling, degree-of-freedom analysis and balances on multiple-unit processes
Balances on reactive systems (steady-state and continuous operation)

Section 3:

Energy balances on non-reacting systems at steady state
Chemical and bioprocess optimization
Scale up in chemical and bioprocess engineering
Special topics in chemical and biomolecular engineering

Class Schedule: 14 week semester, two 50-minute lectures per week, one 110-minute calculation session per week. Homework will be assigned on a weekly basis and collaboration is highly encouraged. Quizzes will be given on a weekly basis during the calculation session.

Assessment: Quizzes: 40% || Homework: 10% || Prelim1: 15% || Prelim2: 25% || Final project: 10%

Course Outcomes:

1. Ability to perform basic engineering calculations, unit conversions and dimensional analysis
2. Ability to define engineering problems, explore solutions with an integrated knowledge of chemistry, physics and mathematics, and critically analyze using spreadsheets and optimization tools to achieve a practical solution
3. Ability to perform material and energy balance calculations: draw and label process flowsheets from verbal descriptions of processes; perform degree-of-freedom analyses; write and solve mass and energy balance equations for single and multiple unit processes with and without chemical reactions
4. Ability to synthesize a complex problem and communicate its solution effectively by written and graphical means

Academic Integrity: Academic Integrity is expected of every Cornell student in all undertakings. The Code of Academic Integrity can be found at:

<http://www.cuinfo.cornell.edu/aic.cfm>

Special Note: In the event of a major campus emergency, course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances.

*All course materials will be made available on Blackboard and Piazza. Syllabus is subject to change prior to course start. Final syllabus will be posted on Blackboard or course online site.

Notable & fun quotes:

“If you learn material balance, you are 50% of a process engineer” Sudhir Sastry

“Imagination is more important than knowledge” Albert Einstein

“Scientists dream about doing great things. Engineers do them.” James Michener

“An engineer connects discoveries made by scientists at the laboratory scale to transform them into a profitable end product for society”