Fall 2019

CHE 472-HM1: Process and Plant Design Honors

Nellone Reid

ChE 472: Process and Plant Design
Fall 2019

Instructor: Dr. Nellone Reid, Senior University Lecturer
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TA:

Class: Monday, 5:45 - 9:35 PM; Room: Tier 411
Office Hours: Tuesday, Friday: 10:00 AM - 12:00 PM

Course Description and Requirements

Process and Plant Design is the capstone course in Chemical Engineering, involving an open-ended process design project, including process simulation, equipment specifications and economics. Each student will be expected to bring all knowledge acquired in previous coursework (mathematics, physics, chemistry, thermodynamics, unit operations, reaction engineering, etc.) and apply it to this class.

Course Objectives

- Develop improved understanding of the basic building blocks of process design, as well as their implementation in steady state process simulation tools
- Design a given process (or parts of) including the selection and sizing of processing equipment and material of construction
- Perform capital and operating cost analysis (cash flow, profitability analysis etc.) for a given project
- Project management/team work
- Deliver a successful written report and oral presentations that communicates technical results from a given process design project.
- Evaluate a process's safety, health, and environmental impacts.

Learning Materials

Textbook Required: Chemical Engineering Design - Principles, Practice and Economics of Plant and Process Design (2nd edition) by Gavin Towler, Ray Sinnott, Elsevier (2013)
ISBN- 9780080966595)

Calculator: A high-end calculator (TI-83, TI-84 or TI-84SE) is required for solving exam problems

Software: ASPEN PLUS, Microsoft Excel, Microsoft Visio, Microsoft PowerPoint

Assessment and Grading

Assignments:

All assignments will count equally. Reports demonstrating attention to detail and organization, as well as research invested into attaining a deeper understanding of a problem and its solution, will tend to score higher. Collaboration aimed at investigating / cross-teaching is encouraged. However, plagiarism will be dealt with harshly, per the Academic Integrity policy explained below.

Assignments/Groupwork	25%
Exams	30%
Final Presentation	15%
Final Project	30%

Each assignment will be graded according to the following criteria:

- Title / Table of contents / Keywords
- Theory / background research
- Governing equations and mathematics
- Results, Analysis and conclusions
- Recommendations
- Comprehension / out-of-box thinking
- Graphs and visual aids
- Appendix
- Organization, language, clarity

Quality of work in each item of the criteria matters. Accordingly, just the inclusion in the report, of a particular item from the above template, does not ensure a full score on that item. Also notice the deliberate overlap between several items in the template, and that some of items emphasize planning and awareness. It is evident that well-defined approach to assembling the report, along with a strong technical effort, will merit a high score on an assignment.

Final Project: Final Project grading will be heavily based on the effective and judicious use of process simulation tools and self-developed excel spreadsheets for equipment sizing and economic evaluation, and others:

- Entering components appropriately and entering conditions/stream properties correctly
- Selecting appropriate thermodynamic/physical properties method(s)
- Obtaining not just converged, but correct/appropriate solutions for a given problem
- Present (written and oral) overall stream tables using requested units of measurement

- Develop block flow diagrams, process flow diagrams and piping and instrumentation diagrams
- Develop economic assessments for a given process

A final project report will consist of the following items (detailed handout will be provided):

1. A Process Flow Diagram (PFD), Piping and Instrumentation Diagrams (P&ID)
2. A Material and Energy balance sheet (stream table)
3. Equipment Design Specifications
4. Solution output from process simulator (zipped input and output files)
5. Economic evaluation of the process (submit excel files)
6. Calculation blocks design parameters (heat exchanger, reactor, etc.)
7. An appendix containing all sample calculations (vessel sizing, data used, graphs, tables, safety related issues)

Policies

NJIT Honor Code: The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of the Dean of Students.

Special Needs: If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

Course Outline

Week	Date	Topic
1	2-Sep	***Labor Day***
2	9-Sep	Introduction; Team Formation; Design Overview; Product Design; Project Description
3	16-Sep	Flowsheet Synthesis
4	23-Sep	Mass and Energy Balances
5	30-Sep	Utilities and Energy Efficient Design
6	7-Oct	Process Simulations
7	14-Oct	Instrumentation and Process Design/Materials of Construction
8	21-Oct	***Exam 1***
9	28-Oct	Capital Cost Estimation
10	4-Nov	Engineering Economy; Economics Case Study; Sensitivity Analysis
11	11-Nov	Financial Operating Model
12	18-Nov	Safety and Loss Prevention
13	25-Nov	***Exam 2***
14	2-Dec	General Site Considerations
15	9-Dec	Last Day of Classes; Open