Syllabus

Process Engineering Economics and Design II

Spring 2020

Instructor:

Nam Sun Wang
Class Hours: Friday 11:00noon-1:30pm AJC2119 (Section 0102); Monday 2:00pm-4:30pm CHM2201 (Section 0103).
Office Hours: Wednesday 3:00pm-5:00pm, Rm 1208 Chemical Engineering Bldg.
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Teaching Assistant:

Yang Yang
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Required Textbooks:

- None, but the textbooks from previous chemical engineering courses contain useful information, including the texbook in CHBE444:

  "Product and Process Design Principles: Synthesis, Analysis and Design" 4th Ed., Warren D. Seider, Daniel R. Lewin, J. D. Seader, Soemantri Widagdo, Rafiqul Gani, Ka Ming Ng, Wiley, 2017, ISBN (print): 9781119282631, 1119282632, ISBN (eText): 9781119257332, 1119257336.

Prerequisites:

CHBE444.

Course Description:

Application of chemical engineering principles for the design of chemical processing equipment. Representative problems in the design of chemical plants will be the focus of this capstone design class. Comprehensive reports are required.

Course Objectives:

This is the chemical engineering capstone design course, where we put together all students have learned previously into a coherant project(s). This class consists of student teams working on two major design projects during the semester; the students will reinforce their teamwork and communication skills and will integrate all previous Chemical Engineering course material in the detailed design and costing of complete chemical plants and in the context of product design problems. Contribution of the Course to Meeting Professional Component This course contributes heavily to the professional component of the Chemical Engineering undergraduate curriculum - it is the capstone design class with projects chosen from chemical process plants that currently are under construction or being studied in the chemical processing industry, and chemical product design problems chosen from state-of-the-art chemical products. Sources of projects include: projects developed in conjunction with an industrial partner; annual AIChE design contest problems and projects of current industrial interest. In the past, the projects have included biofuel refining, hydrogen production from landfill gas, and solar-grade polysilicon production, syngas, ammonia, sweetening of sour gas, ...

Relationship of Course to Program Objectives

In this course, the program objectives that are most relevant are the ability to apply knowledge of chemical engineering fundamentals to identify and solve chemical engineering problems (Outcome 1), a broad knowledge necessary to understand the impact of engineering solutions in a global and societal context (Outcome 4), an ability to perform step-by-step design of engineered systems and chemical processes (Outcome 5), an awareness of safety and environmental issues as an integral part of the chemical engineering profession (Outcome 7), the ability to successfully participate in teams (Outcome 8), the ability to communicate effectively through oral presentations and written reports (Outcome 9), professional and ethical responsibilities (Outcome 10) and current technological issues (Outcome 12).e

List of Topics Covered

Chemical process design, building on material and energy balance computations, understanding phase equilibrium and thermophysical property estimation, short-cut design techniques, process optimization, process economics, safety and environmental issues, and energy integration. Application of other fundamental chemical engineering concepts in transport, separation, reaction equilibrium and reactor design, and various chemical process unit operations.

You are expected to know:

Since this is a capstone design course, you are expected to have mastered fundamentals of core chemical engineering concepts in: material/energy balance, computation, thermodynamics, transport, separation, reaction equilibrium and reactor design, process control, and various chemical process unit operations. In addition, you are expected to know the following specific topics covered in CHBE444.

- Flowsheet synthesis, simple material and energy balances, rapid evaluation of design alternatives
- Shortcut distillation, absorber column, flash drum, and other separations unit operations calculations
- Separation sequences using simplified distillation columns, column hydraulics considerations
- Shortcut reactor sizing using space velocity
- Reactor and pressure vessel, distillation/absorber column, heat exchanger, pump, and compressor sizing and costing
- Process utility calculations, heat exchanger networks, pinch design
- Operating and capital costs, return on investment, discounted cash flow calculations, net present value
- Aspen simulation, selection of thermodynamic models, detailed designs, elements of process optimization
- Process safety concepts
- project planning (gantt charts, critical path)

Grading:

The outcomes will be measured by ~~individual assignments,~~ team assignments (i.e., interim reports), team presentations on assigned topics relevant to the project(s), and written project reports (a few interim reports and one final written report for each project), and final oral report|presentation for each project. There will be no in-class sit-down examinations. The semester grade will be based on the following assessments.

Assessment	Weight
~~homework assignments (individual effort)~~	~~15%~~
homework assignments (team interim project reports)	20%
presentations (team effort, peer evaluated)	15%
final project presentations+reports (team effort)	40%
end-project peer evaluation (by team members)	25%
total	100%

Homework|reports are due electronically at ELMS at the beginning of the class (or at the individual group meetings with the instructor) on the specified due date; no late homework|reports will be accepted unless individually arranged with the instructor *before* the due date with a valid excuse. To help facilitate discussion during individual group meetings with the instructor, bring a hardcopy of most relevant materials (e.g., process flow diagrams) to the meeting; in addition, you may present your latest results on a laptop. ~~Discussion among classmates (within each group or outside) is allowed in solving *individual* homework assignments, but each student must do his/her own work (no copying!).~~ On the other hand, project reports (both interim and final) represent a team effort, and the entire team collectively receives the same grade for each team assignment. How each team divides up its members' responsibilities within is each team's own perogative. Likewise, the team interim/final reports must be the team's own work -- no copying of other team's work nor work from beyond this class (e.g., project reports from previous years or from another school). Adjustment for different team members is through peer evaluation conducted at the end of each of the two projects.

Class attendance is required. "Class attendance" refers to attending the project description lectures, team presentations, and individual team meetings with the instructor.

Plagiarism and academic dishonesty absolutely will NOT be tolerated, and suspected incidence will be referred to the Student Honor Council of the Judiciary Programs. It is your responsibility to consult the instructor whenever there is any doubt on the definitions of these terms or on the allowable materials on each specific homework assignments or reports. See Policy on Academic Integrity.

For a team assignment (e.g., presentation, reports etc.), if one team member is guilty of plagiarism, it is likely that the Student Honor Council will hold responsible every team members whose name appear on that assignment.

Whether or not you sign explicitly in each assignment or exam, it is assumed that you adhere to the following University of Maryland's Honor Pledge.

"I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination."

If you have a documented disability and wish to discuss academic accommodations with the instructor, please do so as soon as possible.

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Forward comments to:

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