

# ChE F473K Summer 2020

## Process Design and Operations

**Instructor:** Thomas Edison

Office: CPE 4.458

Office Hours: Zoom

Telephone: 471- 4438

[tedison@che.utexas.edu](mailto:tedison@che.utexas.edu)

**Class time:** Class: M/W/F 9:30 – 12:30 Zoom Sessions

Zoom Tutorial M/W 2:00 - 4:10

**Text book:**

Analysis, Synthesis, and Design of Chemical processes (5<sup>th</sup> edition) by R. Turton, J. A. Shaeiwitz, Prentice Hall 2018

**Final Grade:**

Homework / mini-projects/ Zoom presentation 30 %

Exams and quizzes 40 %

Design project report/Zoom presentation 30 %

**General Outline / Topics Covered**

- 1) Process design overview
- 2) Process economics
- 3) Flowsheet analysis
- 4) Computer simulation
- 5) Process analysis
- 6) Mini design project
- 7) Special topics: safety, environmental, energy conservation

NOTE: The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY.

## Course Objectives

Develop professional skills in the development, design, and operation of chemical processes involving a variety of unit operations (absorption/stripping, distillation, extraction, adsorption, crystallization, chemical conversions, etc) and a variety of industrial sectors (petroleum, chemical, power production, microelectronics, biomedical, environmental, etc).

Provide exposure to process equipment design and operations through class lectures and individual study during team project execution.

Provide training and experiences in developing their communication skills (reading, writing, oral presentations, listening) through formal course training, team project execution, team project presentations, team project reports, and class exercises.

Provide training and experiences in sound problem solving approaches [define the problem and what is known, what additional information is needed, how do we obtain/measure the needed information, what techniques can be used to solve the problem, what is the best approach to obtain a good (timely, adequate accuracy, and cost effective) solution, and does this solution make sense/what is the best way to verify it.]

Provide adequate training and experiences in the use of engineering tools such as computer process simulation and economic models.

Provide learning environment that stimulates students' curiosity and interest in solving challenging engineering problems.

Provide learning environment that encourages students to "learn on their own" and feel responsible for their own career development.

Provide learning environment that encourages students to conduct their professional activities in a fashion consistent with the engineering code of ethics.

## Knowledge, Abilities, and Skills Students Should Have Entering This Course:

1. Basic Math, Chemistry, and Physics
2. Set-up and solve macroscopic mass balances (ChE317, ChE353, and ChE354)
3. Set-up and solve macroscopic energy balances (ChE317, ChE353, and ChE354)
4. Ability to size piping networks, valves, pumps, compressors, and flow meters for simple and branched flow systems (ChE354).
5. Ability to determine heat transfer coefficients and size heat exchangers (ChE354).
6. Ability to calculate physical and chemical equilibrium for ideal and non-ideal systems (ChE322, ChE353, ChE363, ChE372)
7. Ability to size various separations systems, specifically distillation, absorption, adsorption extraction, and membrane separation processes (ChE363).
8. Ability to analyze various reaction systems and size chemical reactors for specific reaction systems (ChE372).

Basic computer skills (ChE448).

9. Can use process simulation models to analyze the performance of a separations' unit operations, such as distillation (ChE363).
10. Write reports (ChE333T, Ch153K) and make oral presentations (ChE333T).

### **Knowledge, Abilities, and Skills Students Should Gain From This Course:**

1. Define the approach and solve process design problems.
2. Develop confidence in solving open-ended problems.
3. Obtain appropriate data for solving problems.
4. Perform cost estimations, profitability analyses, and alternative investment evaluations.
5. Select appropriate process equipment and materials of construction.
6. Effectively analyze and troubleshoot results obtained from process simulation models.
7. Develop project management plans.
8. Understand typical process development steps.
9. Prepare effective project reports.
10. Give effective oral presentations.
11. Develop an appreciation of process designs in several industries.
12. Develop an appreciation for process safety, product liability, and environmental control issues.
13. Develop an appreciation for the importance of engineering professionalism, e.g. engineering.

### **Criteria 2000 Outcomes Achieved: ChE 473K is a Capstone Course**

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design a system, component, or process to meet desired needs.
3. An ability to function on multi-disciplinary teams.
4. An ability to identify, formulate, and solve engineering problems.
5. An understanding of professional and ethical responsibility.
6. An ability to communicate effectively.
7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.