**ChE 355 – Process Simulation and Design**

**Spring 2018**

Instructor: Dr. Richard Turton

Office: 433 Engineering Sciences Building

Prerequisites: PR or CONC: CHE 312 and CHE 325

Credit Hours: 2 hr

Phone: 304-293-9364

Class: MW 1:00 – 2:15 Room AER 137

Office Hours: T, Th 9-10 am or by appointment

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**Course Goal**

#### The application and use of chemical process simulation software to the design of a chemical process.

#### **Learning Outcomes**

In partial fulfillment of *ChE Educational Outcomes 1, 2, 3 and 4* (see “Undergraduate Program Mission, Outcomes and Objectives” statement), at the conclusion of this course, you will be able to:

1. Demonstrate how the term “design process” applies to developing chemical engineering processes
2. Apply different methods for solving large steady state (SS) flowsheeting problems;
3. Identify a sufficient amount of input data needed to solve a complex flowsheet problem;
4. Demonstrate the ability to choose the correct thermodynamic packages when performing simulations;
5. Demonstrate the ability to simulate reactors, distillation towers, heat exchangers, and other common process equipment in a process simulator
6. Demonstrate the ability to analyze and troubleshoot problems in a simulation;
7. Develop a base-case simulation of a chemical process and identify areas for improvement;
8. Demonstrate the use of miscellaneous features of the process simulation software including how to use the equipment sizing functions
9. Demonstrate effective communication in both written and oral formats
10. **Course Policies** (exceptions at discretion of instructor):

This course is problem-set based because the best way for students to learn about the process simulator is to work on problems that involve the application of the simulator to the design and optimization of a preliminary chemical design.

1. All problem sets are due at the beginning of class or at the stated time.
2. A late assignment = no assignment.
3. You are strongly encouraged to work on each problem set **by yourself**. Help will be provided by TAs in the course and will be your best resource for assistance. Assignments that are obviously **copied** will receive no credit and you will be subject to academic disciplinary action consistent with WVU’s policies.
4. Problem sets should be neat, logically laid out, and be easy to follow. Each problem should start on a new page.
5. You must participate and receive a passing grade (D or better) in the end of semester group design project in order to pass the course.

**Cell Phone Policy**

**All cell phones must be turned off during class.**

### Grading

# Problem sets will have equal weighting: 50 points

# Project\* 50 points

Technical approach - 25 points

Oral Presentation - 10 points

Written Report - 15 points

# Total 100 points

\* The purpose of this group activity is to work as a cohesive team to solve a problem and not to work as 4 or 5 individuals. The result of the team’s effort should be considerably better than the work performed by any one individual. The determination of the project grade will be determined in two steps. **First**, the instructor will evaluate the grade for the project based on the written and oral presentations for each group – this determines the group’s grade. **Second**, the group member’s grade will be adjusted based on their level of participation in the group as determined by confidential feedback from each group member about the performance of other members in the group. The averaged grade for all group members will be the grade determined by the instructor but grades for individual group members could vary considerably from this value. A failing grade (F) in the project results in a failing grade in the course – no exceptions!

# The grading scale is ≥ 90% A

# ≥ 80 and <90% B

# ≥70 and <80% C

# ≥60 and <70% D

# <60% F

1. **Required Texts:** None – PowerPoint overheads and other notes will be suppliedby instructor.
2. **Guidelines for Written and Oral Reports**

Specific guidelines for the written and oral reports will be distributed prior to the project. Students should read these carefully and understand them.

1. **Other Course Policies**

There are a series of course policies available at the following website that apply to this course <http://facultysenate.wvu.edu/curriculum-gec-info>. The instructor will abide with these policies and procedures.

* [Academic Integrity Statement](http://facultysenate.wvu.edu/r/download/200152)
* [Adverse Weather Commitment](http://facultysenate.wvu.edu/r/download/197994)
* [Attendance Policy](http://catalog.wvu.edu/undergraduate/enrollmentandregistration/#enrollmenttext)
* [Inclusivity Statement](http://facultysenate.wvu.edu/r/download/155054)
* [Incomplete Grades](http://catalog.wvu.edu/undergraduate/enrollmentandregistration/#gradestext)
* [Sale of Course Material](http://facultysenate.wvu.edu/r/download/213007)
* [Sexual Misconduct Statement](http://facultysenate.wvu.edu/r/download/207290)
* [Student Evaluation of Instruction (SEI) Statement](http://facultysenate.wvu.edu/r/download/15709)

**Simulation of Chemical Processes – Tentative Weekly Schedule**

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| --- | --- | --- |
| Week | Topics | Problem Set |
| 1 | **Course introduction**  Introduction to steady state simulators  Complexity of problems |  |
| 2 | Structure of the software (simulator) interface  Setting up a simulation - terminology and sequence of problem solution  Recycle structure in process simulation | 1 |
| 3 | Specifying process conditions  Specifying thermodynamics packages and using the “expert system” | 2 |
| 4 | Regressing Thermodynamic data | 3 |
| 5 | Solution methods for flowsheets – stream tearing and approaches to solving problems with recycle(s) | 4 |
| 6 | Specifying equipment parameters - Reactors, Distillation Columns, Heat Exchangers | 5 |
| 7 | Equipment sizing (and costing) | 6 |
| 8 | Sensitivity and Optimization Studies | 7 |
| 9 | Process case study | 8 |
| 10 | Process case study | 9 |
| 11 | Work on design project (reviews of progress for groups) |  |
| 12 | Work on design project (reviews of progress for groups) |  |
| 13 | Work on design project (reviews of progress for groups) |  |
| 14 | Work on design project (oral presentations) |  |
| 15 | Work on design project (oral presentations) |  |