## 1. ChE 496 – Chemical Engineering Laboratory II

#### 2. Credits and contact hours

3 credits, 6 contact hours (0;6;0) (0 lecture h/wk; 6 lab h/wk; 0 recitation h/wk)

#### 3. Course Instructor or Coordinator: Irina Molodetsky

#### 4. Instructional Materials

R. Barat and I. Molodetsky "*Manual for ChE496 Chemical Engineering Laboratory II*" Otto H. York Department of Chemical and Materials Engineering, Newark, NJ 07102. The last version of the manuals is uploaded to the Canvas page of the course <u>http://canvas.njit.edu</u>.

## 5. Specific Course Information

## a. Description:

This capstone laboratory course includes experiential learning of mass transfer, separation, reaction engineering, and process dynamics and control. Emphasis is on the design of the experiment, safety and quality of the experimental data, predictive modeling, team work and ethical knowledge sharing.

**b. Prerequisites:** ChE 349, ChE 489, ChE 495, ChE 339

## 6. Educational Objectives

The student will be able to

- 1. formulate experimental approach and design experiment for given objectives
- 2. perform Hazards Assessment and Risk Control of the experiment
- 3. identify and apply theoretical models (steady or unsteady) to simulate the experiment
- 4. predict experimental data using appropriate software and writing code
- 5. verify experimental techniques, conduct the experiment and determine the sources of experimental errors
- 6. analyze and interpret data, leading to conclusions and suggestions on further work
- 7. apply previous knowledge from peer-reviewed literature or reports
- 8. report data and data analysis consistent with the assigned reporting structure
- 9. work in teams, assume various responsibilities, create supportive and collaborative environment for each team member, provide constructive feedback to team members

## 7. Topics

- 1. Continuous Stirred Tank Reactor (CSTR) reaction, dynamics, two-phase systems
- 2. Non-catalytic batch reactor (NCBR) reaction, dynamics, safety, proteins
- 3. Catalytic Batch Reactor CBR) reaction, dynamics, safety, control
- 4. Semi-Batch Reactor (SBR) reaction, dynamics, safety
- 5. Batch Distillation (BD) separation, control
- 6. Continuous Distillation (CD) separation, control (distillation, rectification)
- 7. Liquid-Liquid Extraction (LLE) separation (extraction, distillation)
- 8. Gas Absorption (GA) separation (absorption, desorption), environmental safety
- 9. Materials Characterization X-Ray diffraction, electron microscopy

## 8. Course Structure

- 1. Each team of 3-4 students complete 4 experimental studies (4 cycles) using provided experimental equipment
- 2. The goals, objectives and specifics of the experiments are discussed during the planning sessions
- 3. After the planning session with the instructor and preparation for experiment, each team submits to Canvas a set of four documents: Experimental Plan (word) and (Excel) formats; Predictive Model (Matlab, Python, or PolyMath); Hazards Assessment and Risk Control (Excel) prior to the 1<sup>st</sup> experimental session in the cycle.
- 4. Each team has a Mandatory Team Discussion. A team leader and instructor completing grading of the team discussion.
- 5. At the end of each cycle, a team submit a written paper (word and pdf) (Cycles 1 and 3) or make a team presentation (ppt format) (Cycle 2 and 4)
  - a. First submission is draft,  $2^{nd}$  submission is final (1 week after feedback)
  - b. High quality draft submission is rewarded by extra points
  - c. All teams are offered to have a mock presentations (scheduled with the instructor)
- 6. At the end of the semester, each student has an oral discussion with the instructor and TA in the format of a job interview (based on the completed experiments)
- 7. Final Exam is a team presentation of the work conducted during Cycle 4
  - a. All teams are strongly encouraged to have a mock presentation scheduled for a date no later than 5 days before the Final presentation

# 9. Communication

- 1. This course will use the NJIT Canvas site accessed by <u>http://canvas.njit.edu</u> for all communications regarding changes in the schedule, status of the experiments, score rubrics, files and documents.
- 2. All online communication will be done on Zoom.
- 3. Team discussion scheduling will be done on Canvas.
- 4. Any additional face-to-face team or individual discussions can be scheduled during the office hours or online outside of the office hours.

## 9. Teamwork

- 1. Contribution to the teamwork and professional behavior is assessed through CATME.
- 2. Assessment after the 1<sup>st</sup> experiment is not taken into account and serves as an observation and learning about teams and professional interaction in the teams
- 3. Assessment after Cycles 2-4 are used as a multiplier to number of points earned by a team member
- 4. The instructor can overwrite CATME based on the suggested recommendations from CATME and discussions with team members

## **10. Grading**

- 1. Each cycle is rewarded by 25 points
  - a. Planning and preparation for experiment -7.5 points

- b. Team discussion 7.5 points
- c. Submitted work or presentation 10 points
- 2. Individual oral discussion at the end of the semester -5 points
- 3. All submissions are done on time and complete -4 points to each team member
- 4. Laboratory Safety improvement 1 point (validated by instructor and TA)
- 5. Participation (asking a good question during the presentations) -0.5 point (validated by instructor and TA)

Grading rubrics help you in assessment of your professionalism. If my expectations in the rubrics are unclear for you – it is YOUR responsibility to discuss them with me BEFORE you submit your work on Canvas.

Above 90 A Above 85 B+ Above 80 B Above 75 C+ Above 70 C Above 60 D Below 60 F

## 11. Professional behavior

- 1. Follow Laboratory Safety
- 2. Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

## http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. *Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.* If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at *dos@njit.edu*"

www.njit.edu/academics/pdf/academic-integrity-code.pd

## 12. Accommodations due to a disability

If you need accommodations due to a disability, please, contact Marsha Williams-Nicholas, Associate Director of Disability Support Services, in Kupfrian 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be require authorizing your accommodation will be required.