CHE 496-00x, SPRING 2025, SYLLABUS

OTTO H YORK DEPARTMENT OF CHEMICAL AND MATERIALS ENGINEERING @ NJIT

REES B. RANKIN

INTRODUCTION

CATALOGUE DESCRIPTION

"In this second course in chemical engineering capstone laboratory, experiments are conducted in the areas of mass transfer, separations, reaction engineering, and process dynamics and control. Bench and sub-pilot-scale equipment is used. Oral and written reports are prepared by the students."

INSTRUCTOR GOALS

Through successful completion of this course, students will experience hands-on operation of lab-to-sub-pilot scale unit operations equipment, combined with rigorous mathematical prediction and validation of observed phenomena as compared to phenomenological and otherwise typical textbook equations. Students completing this course will be challenged to not just conduct the laboratory experiment, but to fully understand what they observe and explain why it occurs. This course helps bridge the typical core course lecture material to the real world operation of chemical engineering equipment which does not always behave "ideally".

PREREQUISITES AND/OR COREQUISITES

PREREQUISITES

CHE 349,360,380, 396, CHEM339, MATH225A

COREQUISITES

CHE 460, 489

CLASS MEETING TIMES AND LOCATIONS

TUESDAYS 13:00 TO 16:00

Tiernan Hall, 007B (in the basement) for in person experiments.

THURSDAYS 13:00 TO 16:00

Tiernan Hall, 007B (in the basement) for in person post-experiment discussions.

INSTRUCTOR AND TA TEAM

LEAD INSTRUCTOR

Rees Rankin, Ph.D. **rees.b.rankin@njit.edu**

Office Hours (IN PERSON, OR VIA ZOOM BY REQUEST WHEN POSSIBLE).

Office Location : B007/D OR YORK 222

Mon:	12:45 PM- 14:45 PM
Wed:	12:45 PM- 14:45 PM
Friday	by request, when possible

You can also book specific request times through my Doodle page. I will make some other time slots each week; they will not be constant. They will be based around other meetings and non-class duties I have. So for example, one week it might mean all of Monday is free. Another week it might mean Friday afternoon is free. You'll need to check regularly, but I will make as much time available as possible.

LINK TBD / WILL BE POSTED ON CANVAS ANNOUNCMENTS

STUDENT TA'S

TA	TBD?
	TBD?

ALTERNATE TA (if needed in emergency)

Shawn Yetman shawn.yetman@njit.edu

*Note : The instructor grades all student work except for Final Oral Presentations. The TA(s) assist with conducting the lab experiments with you (or your team) but do not contribute grading/marks to your work except for the Final Oral Presentation where they will provide Q&A following your presentation, in collaboration with the Instructor.

ATTENDENCE

POLICY

Attendance for **ALL** lab sessions OF YOUR TEAM, and all "lecture" sessions is **Mandatory**! . Attendance on "off-weeks" for your team is optional and welcome. If you need to miss class for an approved reason, let me know in advance if you can. Make sure your group knows in advance of your absence, if you can, and document all members' approval. Professional behavior is expected! Students who do not attend lab sessions (no approved absence) will be removed from their teams and required to conduct work independently.

F2F MODE STATEMENT(S)

GENERAL

Our course for Spring 2025 is listed as a Face to Face (F2F) class and will be run as such unless there is a change in university policy or a government mandate requiring a change. If the Department, University, or other operating government agency above the Instructor's "paygrade" dictate we must change operation due to worsening COVID or other emergency, then we can and must follow these requirements. In such an event, supplemental information to this document will be provided as needed to adapt operation of the course accordingly.

IF any exist, you will be required to follow any and all UNIVERSITY COVID safety requirements and policies in place for this course, at all times. Failure to do so may result in removal from the course.

COURSE ASSIGNMENT AND GRADE STRUCTURE (CONVERGED MODE)

ASSIGNMENT GRADE WEIGHTINGS

Five experiments will be assigned to each group. All reports and presentations are to be group efforts and submissions. Electronic submissions are required and they *must* contain handwritten/signed statements of each group member acknowledging their contribution.
{Therefore, the final product must have at least 1 scanned page after being signed appended to the end of the document PDF}.

• Intro/ Day1 General Assignments	2.0%	
• Kinetics/Separations Assignments	10.0%	
• Scholarly Paper #1 + Oral Presentation #1]	12.0%	
• Scholarly Paper #2+ Oral Presentation #2	12.0%	
• Scholarly Paper #3 + Oral Presentation #3	12.0%	
• Scholarly Paper #4 + Oral Presentation #4	12.0%	
• Scholarly Paper #5 + Oral Presentation #5	12.0%	
• Best Paper Bonus	2.0%	
• Best Presentation Bonus	2.0%	
• Final Oral Presentation (peers)	24.0%	DURING FINALS

* NOTE: Drafts of written reports (Scholarly Paper) and oral presentations– due after experiment is completed (see Canvas schedule) along with Excel Sheets of Data/Calculations. These will be returned with comments & feedback within 24 hours, usually within 12 hours, so that you can meet the final version Paper/Presentation deadline. It is in your best interest to turn in the draft as soon as

reasonably possible so you have more time to make revisions based on feedback.

** NOTE: The Gradebook in Canvas will initially reflect a team/group score on an assignment. After CATME metrics are submitted, individual scores may be adjusted by the CATME factor if it is not equal to 1.0. You will see a note documenting this change if such occurs.

***** NOTE: The real-time CANVAS Gradebook Course Grade will not be accurate until the end of the semester due to the asymmetric nature of the assignment weights. I will post an excel calculator you can use to verify your current grade in real time. The individual assignment grades in Canvas will of course, always be accurate.**

COURSE GAMIFICATION REWARDS SYSTEM

The Canvas LMS will provide opportunities for students (as individuals, and as teams) to provide evidence of supplemental work/achievement in various areas that will activate various rewards, incentives, and extra credit opportunities. See Canvas LMS itself for outline and information. **Participation in these course elements can ONLY help increase your learning success and grade**. It can not lower your grade in any way. THE team with the highest badge count will earn the privilege that the final project- so long as it is a passing performance (not an F) cannot and will not lower their overall course grade; they also get the privilege of assigning specific deliverables to each team/project in the final project presentation (***with help and subject to discretion of instructor***). In the event of a "tie", the team who arrives at their badge count sooner/earlier "wins".

GRADES (LETTER SCALE)

90 to 100 : A	77 to <81 : C+	
86 to <90 : B+	73 to <77 : C	<65 : F
81 to <86 : B	65to <73: D	

Note: there is no further rounding or curving of Grades for this course. If your final average is an 89.9913, that is an B+, not an A.

LATE PENALTIES & EXTENSIONS

The instructor has decided to afford ALL students/groups a total of 5 Extension Days for the semester. These come with ZERO grade penalty and ZERO need to justify or excuse why you need the extension. You may use all 5 days on one assignment, or 1 day each on 5 assignments, or whatever suits your teams' needs. However- to use the extension, you *must* post in Canvas on the day prior to due date for the assignment that you need to use the extension. {*In other words if due Thursday, and you want to use 2 extension days, you have to tell me that on Canvas by the end of Wednesday*}. After you have used your 5 free extension days, any unexcused late submissions will lose 20 % of the maximum document/assignment score per day late.

ASSIGNMENT RUBRICS

Each assignment of the various listed above will have its own rubric in the Canvas site explaining how it will be graded.

Read the rubric(s) carefully ; **good grades** are **rather easily achieved** in this course by:

1. Conducting the experiment correctly.
2. Analyzing the results correctly and with thorough thought.
3. **Following the Rubric** to explain your experiment in the report/presentation.

COURSE CALENDAR/SCHEDULE

DATES/ETC					REACTORS			SEPARATIONS			DELIVERABLES			
Class session #	Week #	Day	Date		BATCH	SEMIBATCH	CSTR	PT	DISTILL	LLE	PRELAB	WRITTEN	ORAL	OTHER
1	1	Tues	1/21/2025	INTRODUCTION/SYLLABUS										
2	1	Thurs	1/23/2025	ALL TEAMS- KINETICS RECAP										DAY 1 ASSIGNMENTS
3	2	Tues	1/28/2025	EXPERIMENT CYCLE 1	A	B	C				A,B,C			
4	2	Thurs	1/30/2025											KINETICS HW
5	3	Tues	2/4/2025		D	E	F				D,E,F			
6	3	Thurs	2/6/2025											
7	4	Tues	2/11/2025	EXPERIMENT CYCLE 2	C	A	B				A,B,C	A,B,C	A,B,C	
8	4	Thurs	2/13/2025											
9	5	Tues	2/18/2025		F	D	E				D,E,F	D,E,F	D,E,F	
10	5	Thurs	2/20/2025											
11	6	Tues	2/25/2025	EXPERIMENT CYCLE 3	B	C	A				A,B,C	A,B,C	A,B,C	
12	6	Thurs	2/27/2025											
13	7	Tues	3/4/2025		E	F	D				D,E,F	D,E,F	D,E,F	
14	7	Thurs	3/6/2025											
15	8	Tues	3/11/2025	ALL TEAMS- SEPARATIONS RECAP								A,B,C	A,B,C	
16	8	Thurs	3/13/2025	ALL TEAMS- LLE THEORY										
17	9	Tues	3/18/2025	SPRING BREAK								D,E,F	D,E,F	
18	9	Thurs	3/20/2025											
19	10	Tues	3/25/2025	EXPERIMENT CYCLE 4				A	B	C	A,B,C			
20	10	Thurs	3/27/2025											SEPARATIONS HW
21	11	Tues	4/1/2025					D	E	F	D,E,F			
22	11	Thurs	4/3/2025	WELLNESS DAY										
23	12	Tues	4/8/2025	EXPERIMENT CYCLE 5				C	A	B	A,B,C	A,B,C	A,B,C	
24	12	Thurs	4/10/2025											
25	13	Tues	4/15/2025					F	D	E	D,E,F	D,E,F	D,E,F	
26	13	Thurs	4/17/2025											
27	14	Tues	4/22/2025	EXPERIMENT CYCLE 6 + FINAL PROJECT				B,E	C,F	A,D	A-F	A,B,C	A,B,C	
28	14	Thurs	4/24/2025											
29	15	Tues	4/29/2025	ALL TEAMS- FINAL PROJECT START								D,E,F	D,E,F	
30	15	Thurs	5/1/2025	ALL TEAMS-HELP SESSION 1										EXP6/ FP MILESTONE 1
31	16	Tues	5/6/2025	ALL TEAMS-HELP SESSION 2										EXP6/ FP MILESTONE 2
32	16	Thurs	5/8/2025	READING DAYS BEGIN										EXP6/ FP MILESTONE 3
33	17	Tues	5/13/2025	FINAL EXAM SOMEWHERE IN THIS										EXP6/ FP MAIN
34	17	Thurs	5/15/2025	WEEK										PRESENTATION

*note this is tentative and may be modified subject to instructor discretion , governing agency mandate, building construction related issues, or other reasons that require significant change to operational scope. However, if “nothing goes wrong”, this is what we will adhere to.

** note that the Final Oral Presentation Day/Time is not yet scheduled, it will be in place of a normal Final Exam. The date/time will be provided to you at the earliest convenience when it is available to the Instructor.

*** note that a Pre-laboratory assignment is due @ 11AM the day of experiment before you conduct the experiment. This can be prepared from the provided template files. The goal is to have a working excel sheet that is arranged , organized, has all needed unit conversions/factors, key equation

calculations set up in advance so that as you acquire data you can easily tell me if it seems to be making sense. Other components of the pre-lab assignment will be a hazard analysis, and a plan (with justification) of what conditions you will acquire data at. *This assignment does not receive a specific grade by itself, but is a part of the rubric for the actual lab report (or presentation) for that given experiment; thus, you should take it quite seriously. If you do not complete this prior to your experiment, you will not be allowed to operate the experiment.*

GROUPS

ASSIGNMENT OF MEMBERS

The instructor will allow students in CHE496 to self-assemble into mutually-determined group selections. Size of teams will be decided on start of course; instructor reserves right to override team formation decision at instructor discretion if problematic issues are noted.

PEER-ASSESSMENT OF MEMBER CONTRIBUTIONS

The instructor will create and provide anonymous online peer-assessment tool(s) such as CATME for group members to disclose and validate the equality of contribution of all team members. **COMPLETION OF ALL CATME SURVEYS IS MANDATORY AND FAILURE TO DO SO WILL RESULT IN A DEDUCTION OF A LETTER GRADE FROM THE STUDENT'S FINAL COURSE AVERAGE.**

CATME FACTORS *WILL BE USED* TO ADJUST INDIVIDUAL SCORES FROM THE TEAM SCORE FOR AN ASSIGNMENT. TAKE YOUR TEAMWORK RESPONSIBILITIES SERIOUSLY. TAKE THE CATME EVALUATION SERIOUSLY. *(INSTRUCTOR RESERVES RIGHT TO OVERRIDE IN EVENT OF OBVIOUS ABUSE OR "FRAUD")*

COURSE MATERIALS & RESOURCES

LMS

Canvas Site: http://canvas.njit.edu --- Please check this site and your email often (**at least once a day**). Project details, in-class work, assignments, announcements, and useful memos will be posted here. Basically, every document for the course will be provided and maintained here.

WEBEX

Links given above for instructor personal WebEx room if you choose to use it for Office Hours instead of In Person meeting. Should NJIT/course be switched to remote learning due to COVID, instructions for "lab" webex links will be provided at a later time.

EMAIL

Instructor and TA emails provided above. Email is a documented and maintained communications tool where permanent records of correspondence can be kept. If you, for example, have an issue logging in to Canvas, you can email me the time, a screenshot, and a copy of your assignment; while I will still ask you to upload the work to Canvas eventually, this will serve as proof that you were not late in your assignment due to your own faults. Instructor and TA will send any announcements to the course through Canvas announcement and bulk class email list.

TEXTBOOK

There is no formal textbook for this course; separate course policy documents and manuals for each experiment will be maintained on the Canvas site. The Manuals are adapted and revised by the Instructor based on previous versions developed by Prof. Molodetsky and Prof. Barat. These Manuals are time-proven and contain everything you need for the experiments. Become *very* familiar with their contents before running the experiments. Optional/Recommended Texts will be listed on Canvas LMS.

MATH SOFTWARE

Math Solver: You must have access to and know how to use one math solver software package. Examples include Polymath , Matlab, Python, or Mathcad (NOT EXCEL!) Excel alone will not get you through this course. All of the software are available for download and you have student license to use. Please reach out to Shawn Yetman if you need help.

SAFETY LECTURES AND MATERIALS

A mandatory lab safety session/presentation will be provided in the first or second week of the course prior to experiments beginning. You will have an assignment to complete to validate you have viewed this content. The instructor and TA(s) will make comments on this topic prior to the start of experiments in the Introductory lecture. There will be separate policy documents on the Canvas site as well. **SAFETY FIRST! BOTH COVID AND OTHERWISE!**

LEARNING OUTCOMES & ABET RELATED

GOALS

Among other things, Students will be able to:

- Operate benchtop-scale reactor experiments
- Operate sub-pilot scale separations based experimental apparatuses
- Plan the experiment and discuss the applicable experimental techniques prior to experimental work
- Perform Hazards Assessment and Risk Control of the laboratory experiment
- Work effectively in a team, assume various responsibilities, create supportive and collaborative environment for each team member
- Successfully apply theoretical models (steady or unsteady) appropriate to simulate the experiment performed
- Develop and conduct an experiment involving process safety issues and active feedback control, and collect good quality data
- Ethically and correctly handle, analyze and interpret data, leading to conclusions and suggestions on further work
- Report the data and analyses in a manner consistent with the assigned reporting structure

OUTCOMES

This course explicitly addresses the following ABET student outcomes: 1, 3, 5, 6,7 and their sub-component outcomes

- 1A: Apply appropriate solution method using math/science/computing principles.
- 3A: Communicate data, ideas, analysis, results in written form.
- 3B: Communicate data, ideas, analysis, results orally considering a wider audience.
- 5A: Participate in the establishment of goals and workplan of the team.
- 5B: Contributes to the development of a collaborative team environment.
- 6A: Develop and conduct appropriate experimentation.
- 6B: Analyze and interpret data, and use engineering judgment to draw conclusions.

NJIT POLICIES

COVID

https://www.njit.edu/pandemicrecovery/frequently-asked-questions

ACADEMIC INTEGRITY

"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"

- DO NOT USE CHATGPT OR OTHER AI WRITING ALGORITHMS TO CREATE WORK FOR THIS COURSE (EXCEPT WHERE IT MAY BE EXCEPTED IN SOFT SKILLS BONUS ASSIGNMENTS) ALTHOUGH THE NJIT DoS DOCUMENT ON ACADEMIC INTEGRITY MAY NOT YET EXPLICITLY FORBID THIS TOOL, THE INSTRUCTOR OF THIS COURSE DOES.

DISABILITY/ACCOMMODATION

"NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact Student Disability Services. Information on the self-identification, documentation and accommodation process can be found on the webpage at: http://www.njit.edu/counseling/services/disabilities.php."

**COVID specific: if you have a legitimate request for accommodation to not conduct the experiments in this laboratory course physically, the request must go through the Dean of Students office (DoS).*

WELCOMING, RESPECTFUL , PROFESSIONAL ATMOSPHERE

NJIT and the CME Department promotes an active , welcoming , professional, and respectful culture and environment for learning and work that involves welcoming all peoples , and encouraging their full participation, valuing their contributions, skills, and abilities and experiences.

All members of the course: students, faculty, staff, and TAs are expected to follow and abide by the NJIT issued codes of conduct, handbooks, and any relevant federal, state and local laws superceding such matters.

Beyond this general philosophy, the university has the following policy against discrimination :

"New Jersey Institute of Technology reaffirms its commitment to a policy of non-discrimination on the basis of race, sex, sexual orientation, age, religion, ethnic origin, handicap or veterans' status in its employment policies, educational programs and activities under university control.
Assuring a climate of equal opportunity is the direct responsibility of all levels of management. Administrative and supervisory personnel are required to comply with applicable government regulations and the affirmative action goals of the university.
Among these are Executive Orders 11246 and 11375 (Affirmative action); the Civil Rights Act of 1964, as amended; Title IX of the Education Amendments of 1972 (Sex Discrimination); Section 504 of the Rehabilitation Act of 1973; Americans with Disabilities Act (Non-discrimination on the Basis of Handicap); The New Jersey Law Against Discrimination, Title 10, Chapter 5, 10:5-1 to 10:5-28, NJ Revised Statutes, as amended; and the New Jersey Governor's Code of Fair Practices, Executive Order No. 21 (1965), as amended and Executive Order No. 39 (1991), "Prohibition in State Government of Discrimination Based on Sexual Orientation."
Any reported act of discriminatory behavior will be investigated through the Office of the Dean of Student Services, the Office of Compliance and Community Relations, or Office of General Counsel and Employment Policy Relations."

https://www.njit.edu/inclusive/university-non-discrimination-policy

Students in this course engaged in discriminatory behaviors towards their peers, TA(s), other students, other employees, or the Instructor will be sanctioned per university policy(ies).

LABORATORY SAFETY

Beyond what is covered specifically in this course, NJIT has numerous Environmental and Safety/Health (ESH) policies and guidelines for appropriate use of laboratory space, either instructional or research. For specific details on the policies (too numerous to list here), please visit the following link. Pay particular attention to the sections on chemical labs, waste, and COVID
https://www.njit.edu/environmentalsafety/laboratory-safety

EXCUSED ABSENCES AND RELIGIOUS OBSERVATIONS

NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence. All instructors must include a reminder on the course syllabus about this notification process. All instructors are required to provide academically reasonable accommodations, allowing students to complete missed assignments, exams, quizzes, or other coursework within the term. Instructors are encouraged to consider the NJIT religious holiday calendar and exercise cultural sensitivity when scheduling assessments or major assignments. All instructors must ensure that students are not penalized for properly documented absences and maintain confidentiality regarding religious observances.

COURSE INCOMPLETES

The grade of "Incomplete" may be given under rare, documented circumstances. Instructors must provide written details of the remaining work and deadlines to the student and the Department Chair. The "Incomplete" grade must be resolved in the next regular semester to avoid automatic conversion to a failing grade. Instructors should not accept work by a student after the end of the semester following the one in which the Incomplete was issued, unless the Dean of Students certifies extenuating circumstances, the instructor is willing to process a late change of grade, and the Office of the Provost pre-authorizes such a change.