

Spring 2021

CHE 240-004: Chemical Process Calculation II

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Syllabus
ChE 240 Chemical Process Calculation II
Spring 2021

Otto H. York Department of Chemical & Materials Engineering
New Jersey Institute of Technology

Spring 2021 Academic Calendar

| | | | |
|----------|----|-----------|--|
| January | 18 | Monday | Martin Luther King, Jr. Day |
| January | 19 | Tuesday | First Day of Classes |
| January | 23 | Saturday | Saturday Classes Begin |
| January | 25 | Monday | Last Day to Add/Drop a Class |
| January | 25 | Monday | Last Day for 100% Refund, Full or Partial Withdrawal |
| January | 26 | Tuesday | W Grades Posted for Course Withdrawals |
| February | 2 | Tuesday | Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date |
| February | 15 | Monday | Last Day for 50% Refund, Full Withdrawal |
| March | 8 | Monday | Last Day for 25% Refund, Full Withdrawal |
| March | 14 | Sunday | Spring Recess Begins - No Classes Scheduled - University Open |
| March | 21 | Sunday | Spring Recess Ends |
| April | 2 | Friday | Good Friday - No Classes Scheduled - University Closed |
| April | 5 | Monday | Last Day to Withdraw |
| May | 4 | Tuesday | Friday Classes Meet |
| May | 4 | Tuesday | Last Day of Classes |
| May | 5 | Wednesday | Reading Day 1 |
| May | 6 | Thursday | Reading Day 2 |
| May | 7 | Friday | Final Exams Begin |
| May | 13 | Thursday | Final Exams End |
| May | 15 | Saturday | Final Grades Due |
| | | | |

General course information

CHE 240 - Chemical Process Calculation II. This course covers the basic principles of energy balances for a variety of engineering systems. Combined with material from other sophomore courses, simple designs of chemical processes are considered. The course uses primarily chemistry and algebra to assess operating performance of a wide variety of chemical processes and equipment.

Days/ Times/Location:

Tuesday, 04:00 PM - 05:20 PM; Thursday, 04:00 PM - 05:20 PM; synchronous online

Pre-requisites: Chemical Process Calculations I (ChE 210), Chemical Engineering Thermodynamics I (ChE 230),

Credits and contact hours

2 credits, 3 contact hours

Course coordinator/instructor

Dr. Boris Khusid

Faculty Memorial Hall 215 (office); 973-596-3316 (phone); khusid@njit.edu (e-mail)

<http://chemicaleng.njit.edu/people/khusid.php> (website)

Office Hours Faculty Memorial Hall R215, Tuesday, 9:30 am-11:30 pm by arrangement to ensure proper social distancing.

Note: you can always schedule an appointment or WebEx meeting by email if the office hour time conflicts with your classes.

Specific course information

Textbooks: Required - Felder, R. M., Rousseau, R. W., Bullard, L. G., “Elementary Principles of Chemical Processes”, 4th Edition, John Wiley & Sons, New York, New York, 2016
<https://www.wileyplus.com/engineering-and-materials-science/felder-elementary-principles-of-chemical-processes-4e-eprof18116/>

Recommended –1) Poling B.E., Prausnitz J.M., O’Connell J.P., “The Properties of Gases and Liquids” 5th Edition, McGraw-Hill, 2004

<https://www.accessengineeringlibrary.com/content/book/9780070116825>

2) Green D.W., Southard M.Z., “Perry's Chemical Engineers' Handbook” - 9th Edition, McGraw-Hill, 2019 or earlier editions

<https://www.accessengineeringlibrary.com/content/book/9780071834087>

Other learning material: The lecture notes to be posted on the class website give a summary of the course material. Please print and have them along with your textbook and calculator in the class. You will make additional notes during the lectures.

Course delivery: Synchronous Online: Students have to attend remotely.

Specific goals for the course:

a. The student will be able to

1. Know basic concepts related to materials and energy balances
2. Draw and label process flowcharts from verbal process descriptions for material balance
3. Write and solve material balance equations for single phase systems and multi-phase systems for both steady-state and transient processes and processes with/without reactions
4. Draw and label process flowcharts from verbal process descriptions for energy calculation;
5. Write and solve energy balance equations based on the 1st law of thermodynamics for both steady and transient processes with /without phase change, or dissolving or absorption, or reactions

6. Use spreadsheets (EXCEL or other software) to solve material and energy balance problems
7. Be professional and responsible in team activities
8. Solve simultaneous materials and energy balance processes, derive differential equation and solve 1st order linear differential equation

b. This course explicitly addresses the following student outcomes: a, d, e, f; (1,4,5)

7. Topics

1. Single phase system properties (Volumetric properties of fluid)
2. Multi-phase system properties (G-L, L-L, L-S systems)
3. Energy balance for open and closed systems (1st law of thermodynamics)
4. Energy balance for non-reactive systems (phase change or solution)
5. Energy balance for reactive systems
6. Materials and energy balance for transient systems (derive differential equation and solve 1st order linear differential equation)

Grading

Your performance will be graded on an absolute scale, so your grade is not affected by how others do. Final letter grades will be awarded based on your weighted average score as follows:

| | |
|-----------------------------|-----|
| Homework (individual) | 10% |
| Quizzes (individual) | 10% |
| Project/group activities | 20% |
| Midterm exam 1 (individual) | 15% |
| Midterm exam 2 (individual) | 15% |
| Final exam (individual) | 30% |

Letter grades will be assigned automatically by an Excel code based on the following totals:

| | |
|----------------|---------------|
| A (Superior) | 90% and above |
| B+ (Excellent) | 85%-89.9% |
| B (Very Good) | 80%-84.9% |
| C+ (Good) | 75%-79.9% |
| C (Acceptable) | 70%-74.9% |
| D (Minimum) | 60%-69.9% |
| F (Inadequate) | Less than 60% |

For success, you are strongly advised to

Review/work on the material of the previous lecture before the next class.

Read the lecture notes and covered sections of the required textbook.

Use the printed lecture notes in class along with the computer and calculator.

Take additional notes during the lectures.

Work out all derivations and examples in the lecture notes and in-class examples on your own after each lecture.

In case of questions, please see the instructor during Office Hours or raise questions in the class. Do not delay it to the exam week.

Policies on assignments/exams and classroom policy

Homework is an integral part of the course:

- Homework (HW) assignments will be posted on Canvas and must be uploaded into Canvas in DOC or PDF format by the due date. Do not send images taking with cell phone! No late HW will be accepted for grading without a documented University authorized absence. All HW assignments will be individual.

- **Homework format:** Failure to observe the following HW conventions will result in a downgrade of the HW score.
- **File name** should include student's first and last names, HW assignment No.
- **Header:** The top of each sheet of a HW assignment must contain the following information from left to right:

| | | | | |
|------------------------------|-----------|------------------|----------|---------------------|
| Student's first & last names | Course No | HW assignment No | Date due | Page No/total pages |
|------------------------------|-----------|------------------|----------|---------------------|

- **Writing:** Homework should be printed carefully and legibly. If it can't be read, it can't be graded!
- **Problem-solution format:** Problems should be clearly labeled and include the HW problem number, brief problem statement and often diagram to illustrate the process, and present basic steps and calculations.
- **Calculations** - Homework should include complete calculations for every calculation presented to demonstrate how results were obtained.
 - Include all units for each term in each equation.
 - Indicate the final solution by boxing it in with a rectangular.
- Feedback on the homework will be provided during lectures, solutions will be discussed and posted on the class website.
- Each problem will be graded individually (up to 5 points). You are allowed to discuss HW problems with peer students, but cannot copy the solution.

Group Project Assignment

Form a team (up to 3 students) to carry out a short review project on applications of the course topics to chemical processes & equipment, prepare and post the progress/final reports & slides on the **class website**, and give an **oral presentation** to the class.

Guidelines for preparing a project, topics & abstracts of previously presented projects and **detailed criteria** for grading the project report and oral presentation are posted on the class website. Posted **titles & abstract of reports** previously presented serve as examples, **but cannot be copied!**

Evaluation of project/group activity

Each student will be asked at the end of the semester to confidentially rate his/her performance/effort as well as that of all his/her group-members. The **evaluation form** posted on the **class website**. The completed evaluation form has to be submitted either as a hard copy in a sealed envelope or as a word-file attached to an e-mail to the instructor.

- Evaluation forms are due on **Reading Day**.
- Submission of the form after Reading Day and before the final exam will lead to a downgrade of the project score.
- A student will not be allowed to take the final exam without prior submission of the self & peer evaluation form.

CME Department policy on electronic devices:

Electronic devices (i.e., cell phones, tablets, and laptops) are allowed for using in class only when the work specifically assigned requires live external connection for data, WebEx online meetings or during in-class presentations.

Classroom policies:

- Attendance of the WebEx online meetings is required. There is a high correlation between failure and poor class attendance.
- Behave professionally and show respect to fellow students and the instructor.

- Cellphones should be turned off during the class.

Quizzes:

There will be quizzes occasionally in the class. If you miss the class, you will miss the quiz that day. There will be no makeup quiz.

ALL EXAMS WILL BE CONDUCTED ON-LINE.

Exam policy:

There will be two midterm and one final exams; they are open book & lecture notes, calculators can be used. Exact date of a midterm exam will be announced a couple of weeks before.

- The comprehensive final exam during Finals’ week will cover the course materials.
- The midterm and final exams must be completed individually, in accordance with the NJIT Honor Code.
- Use the HW format for presenting solutions of exam problems.
- Each exam problem will be graded independently (up to 5 points).
- A missed midterm exam will be averaged into the final grade as zero, unless an excuse is obtained. Excuses are granted only for very serious circumstances attested to by the NJIT Dean of Student Office. A student who has been excused will be required to take a makeup exam.
- A students missing the final exam without a documented reason will get an Incomplete.

Disputing a grade on tests/assignments:

If a student has questions about the grade received for an exam, homework, or classwork he/she must talk to the instructor (or the teaching assistant where appropriate) **no later than a week** after the graded activity has been returned to students. Exam scores can only be disputed during the official Office Hours, not during class time or via email.

Accommodations due to disability: If you need accommodations due to a disability please contact Center for Student Success Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

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: <https://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 <https://www.njit.edu/dos/>

Tentative weekly listing of topics (15-week schedule)

| Week | Book Chapters |
|-------------|-----------------------------------|
| 1 | Review of Chapters 1-4 |
| 2 | Review of Chapters 1-4/ Chapter 5 |

| | |
|----|----------------------------------|
| 3 | Chapters 5/6 |
| 4 | Chapter 6 |
| 5 | Chapter 6/7 |
| 6 | Chapter 7 |
| 7 | Midterm exam 1 |
| 8 | Chapter 7/8 |
| 9 | Chapter 8 |
| 10 | Chapter 8 |
| 11 | Chapter 8 |
| 12 | Chapter 8/9 Midterm exam 2 |
| 13 | Chapter 9 |
| 14 | Chapter 10/Project presentations |
| 15 | Project presentations /Review |