

Spring 2020

## **CHE 611-102: Thermodynamics**

Boris Khusid

Follow this and additional works at: <https://digitalcommons.njit.edu/cme-syllabi>

---

### **Recommended Citation**

Khusid, Boris, "CHE 611-102: Thermodynamics" (2020). *Chemical and Materials Engineering Syllabi*. 104.  
<https://digitalcommons.njit.edu/cme-syllabi/104>

This Syllabus is brought to you for free and open access by the NJIT Syllabi at Digital Commons @ NJIT. It has been accepted for inclusion in Chemical and Materials Engineering Syllabi by an authorized administrator of Digital Commons @ NJIT. For more information, please contact [digitalcommons@njit.edu](mailto:digitalcommons@njit.edu).

# Syllabus

## CHE 611 - THERMODYNAMICS Spring 2020

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

### Spring 2020 Academic Calendar

January	20	Monday	Martin Luther King, Jr. Day
January	21	Tuesday	First Day of Classes
January	25	Saturday	Saturday Classes Begin
January	31	Friday	Last Day to Add/Drop a Class
January	31	Friday	Last Day for 100% Refund, Full or Partial Withdrawal
February	1	Saturday	W Grades Posted for Course Withdrawals
February	3	Monday	Last Day for 90% Refund, Full or Partial Withdrawal, No Refund for Partial Withdrawal after this date
February	17	Monday	Last Day for 50% Refund, Full Withdrawal
March	9	Monday	Last Day for 25% Refund, Full Withdrawal
March	15	Sunday	Spring Recess Begins - No Classes Scheduled - University Open
March	22	Sunday	Spring Recess Ends
April	6	Monday	Last Day to Withdraw
April	10	Friday	Good Friday - No Classes Scheduled - University Closed
May	5	Tuesday	Friday Classes Meet
May	5	Tuesday	Last Day of Classes
May	6	Wednesday	Reading Day 1
May	7	Thursday	Reading Day 2
May	8	Friday	Final Exams Begin
May	14	Thursday	Final Exams End
May	16	Saturday	Final Grades Due

### General course information

CHE 611 - THERMODYNAMICS (3 credits). Principles of thermodynamics developed quantitatively to include thermodynamic functions and their application to chemical engineering processes.

**Days/ Times:** Monday, 06:00 PM - 08:50 PM CKB 124

**Pre-requisites:** undergraduate courses in physical chemistry and thermodynamics, or equivalent.

**Credits and contact hours:** 3 credits, 3 contact hours

### Course coordinator/instructor

Dr. Boris Khusid

Faculty Memorial Hall 215 (office); 973-596-5707 (phone); [khusid@njit.edu](mailto:khusid@njit.edu) (e-mail)

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

**Office Hours** Faculty Memorial Hall R215, Monday, 9 am-12:20 pm

**Note:** you can always schedule an appointment by email if the office hour time conflicts with your classes

### Specific course information

**Required textbook:** Juan J. de Pablo, Jay D. Schieber, Molecular Engineering Thermodynamics, Cambridge University Press, 2014; ISBN: 9780521765626;

<https://www.cambridge.org/us/academic/subjects/engineering/chemical-engineering/molecular-engineering-thermodynamics?format=HB>

**Recommended textbook:** David R. Gaskell, David E. Laughlin, Introduction to the Thermodynamics of Materials, 6<sup>th</sup> Edition, CRC Press, 2017, ISBN 9781498757003

<https://www.crcpress.com/Introduction-to-the-Thermodynamics-of-Materials/Gaskell-Laughlin/p/book/9781498757003>

### Helpful open access textbook:

Howard DeVoe, Thermodynamics and Chemistry, 2<sup>nd</sup> Edition, Version 9, May 2019, hosted by the Department of Chemistry and Biochemistry, University of Maryland, College Park, Maryland  
<http://www2.chem.umd.edu/thermobook/>

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

### Course objectives

1: Provide students with knowledge of fundamental principles of modern thermodynamics and basic concepts of statistical mechanics.

2: Teach students how to develop mathematical models and apply thermodynamic analysis to complex systems such as polymers, colloids and interfaces.

3: Develop skills to work in a team to acquire new knowledge on specific applications of thermodynamic concepts & models and communicate it in written & verbal form

## 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%
In-class group activities	5%
Group project (team work)	25%
Mid-exam (individual)	15%
Final exam (individual)	35%

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

A	(Excellent)	Above 90%
B+	(Good)	80%-90%
B	(Acceptable)	70%-80%
C+	(Marginal Performance)	60%-70%
C	(Minimum Performance)	50%-60%
F	(Failure)	Less than 50%

**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,

**Bring** the printed lecture notes to class,

**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 this to the exam week.

## Policies on assignments/exams and classroom policy

### Homework is an integral part of the course:

- Homework is collected at the beginning of the class.
- Late homework will not be accepted for grading; if you cannot attend the class you have send the solution to the instructor before the class in **.doc or .pdf formats**.  
**Do not send images taking with cell phone!**
- Feedback on the homework will be provided during lectures, solutions will be discussed and posted on the class website; graded homework will be returned
- Each problem will be graded individually

You are allowed to discuss HW problems with peer students, but cannot copy the solution.

### 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, or during in-class presentations.
- The use of electronic devices (i.e., cell phones, tablets, and laptops) that can communicate externally is not allowed during quizzes and exams.

### Classroom policies:

- Attendance is important. There is a high correlation between failure and poor class attendance
- Eating and drinking are not allowed during class
- Behave professionally and show respect to fellow students and the instructor

**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.

**Group project assignment**

Students will work as a team by cooperating in a small group to carry out a project on quantitative thermodynamic models and relevant practical applications, prepare and post the progress/final reports & slides on the class website, and give an oral presentation at the class.

**Guidelines** for preparing a project and **detailed criteria for grading** the project report and oral presentation are posted on the class website.

**In-class project/group activities policy:**

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 is listed in the syllabus and 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 25% reduction of the credit for project.
- A student **will not be allowed** to take the final exam without prior submission of the self & peer evaluation form.

**Exam policy:**

There will be one midterm and one final exam; both are open book & lecture notes, calculators can be used. Exact date of the midterm exam will be announced a week 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.
- Each exam problem will be graded independently.
- 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.

**Disputing a grade on tests/assignments:**

If a student has questions about the grade received for an exam, homework, or project, 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.

**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: <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](mailto:dos@njit.edu)

**Tentative weekly listing of topics (15-week schedule)**

<b>Week</b>	<b>Topic</b>	<b>Book Chapters</b>
1	Introduction	Chapters 1, 2
2	Mathematical background	Chapter 2, Appendix A
3	Postulates of thermodynamics and fundamental relations	Chapters 2, 3
4	Thermodynamic potentials	Chapters 3, 4
5	Thermodynamic stability, single-component systems	Chapters 3, 4
6	Midterm exam	
7	Crystallization of solids	Chapter 4
8	Flow systems	Chapter 5
9	Cycles	Chapter 5
10	Elements of statistical mechanics	Chapters 6, 7
11	Molecular interactions & equations of state	Chapters 7, 8
12	Multicomponent systems and reaction equilibrium	Chapters 8, 9, 10
13	Applications to polymers & interfaces	Chapters 11, 12
14	Project presentation	
15	Final exam	