

Phase Chemical Equilibrium

ECH4123 #12708

Class Periods: W | period 9 (4:05 PM - 4:55 PM) , F | Period 9 - 10 (4:05 PM - 6:00 PM)

Location: NZH 0112

Academic Term: Fall 2019

Instructor:

Tony Ladd

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[Office Hours: TBA, Rm 225](#)

Course Description

Application of thermodynamic principles to systems of variable composition including the study of phase and chemical equilibria (3 credits).

Course Pre-Requisites

ECH 3101 Process Thermodynamics, ECH 3203 Fluid and Solid Operations, ECH 3223 Energy Transfer Operations

Course Objectives

Formulate problems involving phase and reaction equilibria as minimizations of the Gibbs free energy

Calculate composition diagrams for VLE, LLE, and VLLE

Calculate equilibrium compositions of reactive species (primarily gases)

Solve equations for phase and reaction equilibria using numerical methods.

Materials and Supply Fees

N/A

Relation to Program Outcomes (ABET):

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	High
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	
4. An ability to communicate effectively with a range of audiences	
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	High

7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	Medium
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*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

Required Textbooks and Software *Essential Thermodynamics*, by A.Z. Panagiotopoulos, Drios, 2011. (UF library: SCIENCE LIBRARY QD504 .S25 2006). Useful software and a list of typographical errors are posted on the web at <http://driospress.com/et>

Additional Materials

Chemical, Biochemical, and Engineering Thermodynamics by S. I Sandler (any edition)

Course Schedule (approximate)

Week	Week ending	Topic	Resources
1	8/23	Introduction and Review	Textbook: 5.1, 5.2, 5.5
2	8/30	Equilibrium and stability	Textbook: 6.1, 6.2 HW1 due (Quiz)
3	9/6	Phase Equilibrium	Textbook: 6.3 – 6.5 HW2 due (Collect)
4	9/13	One-component systems	Textbook: 7.2, 7.4 HW3 due (Quiz)
5	9/20	Mixture functions	Textbook: 8.1, 8.2 HW4 due (Collect)
6	9/27	Ideal mixtures	Textbook: 8.5, 8.6 HW5 due (Quiz)
7	10/4	Excess properties and activity	Textbook: 8.8, 8.9 HW6 due (Collect) Homecoming 10/4 No Class
8	10/11	VLE for ideal mixtures	Textbook: 9.1 HW7 due (Quiz)
9	10/18	Non-ideal mixture	Textbook: 9.2, 9.3 HW8 due (Collect)
10	10/25	Colligative Properties	Textbook: 9.5, 9.6 HW9 due (Quiz)
11	11/1	Review for Midterm: 10/30 P9 Midterm: 11/1 P9 & 10	HW10 due (Collect) Phase equilibria
12	11/8	Reaction equilibria	Textbook: 10.1, 10.2 HW11 due (Quiz)
13	11/15	Standard states and use of tables	Textbook: 10.3, 10.4 HW12 due (Collect)
14	11/22	More complex reaction equilibria	Textbook: 10.5, 10.6 HW13 due (Quiz)
15	11/29	Thanksgiving No Class	
16	12/6	Review for Final: 12/4 P9	Reaction equilibria HW14 due 12/4 (Collect)
17	12/13	Final Exam: 12/9 10AM - 12PM	Reaction equilibria

Attendance Policy, Class Expectations, and Make-Up Policy

- a Students will be assigned homework from the textbook each week, which will be due the Friday of the following week.
- b Students are encouraged to form small groups (up to 3 people) to work on homework problems. Each group must submit their own solutions – copying solutions from the web or from other students is not permitted, and may constitute an academic honesty violation. A single problem from each homework set will be collected for grading between periods 9 and 10 on alternate Fridays (see schedule).
- c Solutions to graded homework problems will be posted the following week along with solutions to some of the ungraded problems.
- d Quizzes will be held on alternate weeks (see schedule) and will be based on homework assigned the previous week. All quizzes will be closed book – no additional resources permitted.
- e Assigned reading (sections noted in the Schedule) will be included in each weeks overview. Students are expected to be familiar with the material covered in assigned readings, as well as from class and homework.
- f The midterm will be given during class periods, and the final exam during the scheduled time.
- g The midterm and final exams will use Python to compute solutions to numerical problems. Students may bring notes, books, and programs to these exams.
- h You are responsible for all announcements made in class.
- i Requests for re-grading of assignments and exams will only be considered within a one-week period from the time graded work is returned.
- j Grades for individual assignments, quizzes, and tests will be posted on the web. Throughout the semester, you should ensure that they are entered correctly. Corrections will be considered only within a two-week period after the grades have been posted on the web.
- k Students may request a makeup for any activity sponsored by the university, for health reasons, and for family emergencies. Other reasons at the instructor's discretion. Makeup tests and quizzes will be given at the end of the semester. There will be no make up for the final exam except for health or family reasons. In such cases the student will receive an Incomplete grade, with a makeup to be given the following semester. Request for a make up must be made at least 1 week in advance of the assignment.

Evaluation of Grades

Assignment	Percentage of Final Grade
Midterm Exam	30%
Final Exam	30%
Quizzes (7)	20%
Homework (7)	20%
Total	100%

Grading Policy (approximate – subject to modification)

Percent	Grade	Grade Points
85-100	A	4.00
80-85	A-	3.67
75-80	B+	3.33
70-75	B	3.00
65-70	B-	2.67
60-65	C+	2.33
55-60	C	2.00
50-55	C-	1.67
45-50	D+	1.33
40-45	D	1.00
35-40	D-	0.67
0 - 35	E	0.00

Schedule of Homework, Quizzes, Tests

Homework	Every other Friday from 9/5 Period 10
Quizzes	Every other Friday from 8/30 Period 10
Midterm	Fri Nov 1 st Periods 9 & 10
Final	Mon Dec 9 th 10:00am – 12:00 pm

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.