

Phase and Chemical Equilibria

ECH 4123
Section 22159
Spring 2023

Lecture time/place:

MWF 4:05 – 4:55 PM (9th period)
CSE 119

Instructor:

Jaime Benitez
jaime.benitez@ufl.edu

Office Hours: T, R 1:30 – 2: 30 PM, Zoom.

Course Description

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

Course Pre-Requisites / Co-Requisites

Pre-requisites: ECH 3101, ECH 3203, and ECH 3223.

Course Objectives

- Formulate problems involving phase and reaction equilibria as minimizations of the Gibbs free energy
- Relate thermodynamic properties of mixtures to properties of pure components using activity coefficients
- 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

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3) an ability to communicate effectively with a range of audiences	
4) 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	
5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates outcome not significantly addressed by this course.

Announcements

- A weekly announcement may be posted on Canvas on Sundays or Mondays, depending on the schedule for each week. Any additional urgent announcements may be posted by the instructor, and/or brought up during lecture.

Required textbook

- Title: Chemical, Biomechanical and Engineering Thermodynamics
- Author: Stanley I. Sandler
- Edition: 5th
- ISBN: 9780470504796

Course Schedule (subject to change)

Week 1	Course introduction and review
Week 2	Equilibrium and stability
Week 3	Thermodynamic description of mixtures
Week 4	Phase equilibrium in multicomponent systems
Week 5	Multicomponent multiphase systems: Gibbs phase rule
Week 6	Gibbs free energy and fugacity in mixtures
Week 7	Gibbs free energy and fugacity in mixtures
Week 8	Vapor liquid equilibrium in mixtures
Week 9	Vapor liquid equilibrium in mixtures
Week 10	Other types of phase equilibria
Week 11	Chemical equilibrium
Week 12	Chemical equilibrium
Week 13	Chemical reactors
Week 14	Biochemical applications of thermodynamics
Week 15	Review

Exams

- **Dates**
 - February 8, 2023
 - March 10, 2023
 - April 24, 2023
- Each exam is worth 20% of the final grade.
- All exams will be with open notes. They will consist of two parts; the first part will be in the classroom and the second part will be take-home. The take-home portion will be posted on Canvas on the dates posted above by 1:00pm and will be due at 11:00pm.
- The final exam will be optional and in the classroom to make-up for any one of the partial exams.
- Late submissions of the take-homes will be accepted with the following penalties (out of 100 points):
 - Up to 15 minutes late: - 10 points
 - 15 - 30 minutes late: - 20 points
 - 30 - 45 minutes late: -30 points
 - 45 - 60 minutes late: -40 points
 - > 60 minutes not accepted

Attendance policy and make-up policy

- Attendance is not mandatory. **Students are held responsible for the material and announcements made during lecture.**
- Attendance will be checked randomly during the term and the students can earn an **attendance bonus** of up to 3% of the final grade in the course.
- No make-up exams requests will be considered since the optional final exam will serve that purpose.

Evaluation of Grades

Assignment	Percentage of Final Grade
Exams	60%
Homework	40%
Attendance bonus	3%
	100%

Grading Policy

Percent	Grade	Grade Points
90 - 100	A	4.00
87.0 - 89.9	B+	3.33
80.0- 86.9	B	3.00
77.0- 79.9	C+	2.33
70.0 - 76.9	C	2.00
67.0 - 69.9	D+	1.33
60.0 - 66.9	D	1.00
0 - 59.9	E	0.00

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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.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 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>.