EMA 6316 – Materials Thermodynamics

Course Syllabus – Fall 2018

	Office	E-Mail	Office hours
Prof: Richard G. Hennig	154 Rhines Hall	rhennig@ufl.edu	Tue 2-3 pm
TAs: Amani Cheniour	Rhines Hall	a.cheniour@ufl.edu	Thu 2-4 pm

Course Description (3 credit hours)

Thermodynamics of materials systems, surfaces in solids, irreversible processes.

Prerequisites:

EMA 4314: Energetics and Kinetics in Materials Science or any equivalent Thermodynamics course.

Course Objectives

This course is one of the four key technical courses foundational to the MSE graduate program: Materials Thermodynamics (EMA 6316), Diffusion, Kinetics and Transport in Materials (EMA 6136), Structure and Mechanical Properties of Materials (EMA 6313), and Properties of Functional Materials (EMA 6114). As a core course, this class covers a significant amount of graduate-level material and is designed to challenge you to advance your knowledge and skills. Success will require a considerable investment in preparing for lectures by using textbooks and other sources that you seek out, solving problems, and studying for exams. It is expected that you will have to exhibit significantly more independence, initiative, and ownership of the learning process than what was required for success at the undergraduate level.

This class reviews the four laws of thermodynamics as the fundamental basis for thermal and chemical equilibrium and introduces a statistical mechanical viewpoint for fundamental thermodynamic variables and the relationships between them. The students will apply these principles to understanding phase equilibria, phase diagrams, heterogeneous reactions, solutions, surfaces, and defects. The use of thermodynamics for practical scientific and technical applications will be emphasized in the course.

Class Time

Monday, Wednesday, Friday Period 3 9:35-10:25 NEB 100

Text book: (required)

Title: Thermodynamics in Materials Science, 2nd Edition
Author: Robert DeHoff
ISBN: 0-8493-4065-9

Supplementary reading and links to various other resources/websites are provided and updated throughout the semester.

Course Website

The course website is on the Canvas system https://ufl.instructure.com, where you can find the syllabus, lecture notes, homework problems, announcements, and your grades. Please check it frequently.

Lectures

Lectures are critical to success in this MS&E course. Experience has shown that you will be able to get a better grade when regularly attending class. However, I will not require attendance. Questions are highly encouraged. It will make the course more interesting, wake up your fellow students and give me a chance to explain things better. If you do not understand something, chances are that most of the class missed that point too. If you do not ask enough questions, I may start asking you. You are responsible for material presented in lectures, reading assignments, homework, and distributed notes.

Homework

Four homework exercises will be assigned. These homework questions are essential to your study and prepare you for the exams. Some exam questions will be adapted from homework. Homework is usually due back seven days before the corresponding exam. The approximate homework due dates are 9/14, 10/12, 11/9, 11/28. The exact submission dates will be posted in the e-learning assignments. The purpose of homework is to give students an opportunity to evaluate and apply their knowledge. Students may collaborate on homework; however, the submitted assignment must represent their own work and preparation. Please see the TAs or me during their office hours to discuss homework problems.

Homework in its entirety must be word processed. For some problems, you will require a suitable math package with graphing capability, e.g., Excel, MatLab, Python. Files have to pdf, doc, docx, or pptx. Picture files (jpg, etc.) are not accepted.

Homework needs to be submitted online on e-learning. Email is not acceptable for submission of homework. Hard copies are also not accepted.

Homework will be evaluated on the following basis:

- Excellent work: 100
- Assignment acceptable: 85
- Homework submitted (showing effort): 70
- Homework submitted no or small effort: 0
- **No late homework assignments will be accepted.**

Quizzes and Interactive Learning

We will have online quizzes covering current and recent lecture material. The quizzes will typically consist of about four quick questions that should take about 10 minutes. The quizzes serve as feedback both for you and me.

I addition, we will use Kahoot in class to provide instant feedback about essential concepts. You will need an online electronic device (smartphone, tablet, computer) for the lectures running the website tool Kahoot.

Exams

You will be given 4 in-class exams throughout the semester. Review sessions will be given prior to each exam. Exams usually consist of short answer questions to evaluate your familiarity with the course content and some longer problems designed to test your ability to apply concepts to new situations, i.e. to promote critical thinking. Unless otherwise informed, one sheet of prepared personal notes may be used to assist you in completing examinations. In class exams use randomized seating assignment. Exam work must be individual; collaboration is never allowed. Observations of cheating will be promptly reported by the exam proc-

tor. Please see UF's statement on academic honesty: https://sccr.dso.ufl.edu/process/student-conduct-code/.

There is no final exam in this class. Exam dates are scheduled (changes are possible) for:

Exam 1: September 21, 2018
Exam 2: October 19, 2018
Exam 3: November 16, 2018
Exam 4: December 5, 2018

There will be NO Final Exam. You have two weeks after the test results are posted to resolve any questions about scores and grades. No changes to your exam grade will be made after that time.

EDGE Student Submission Policy

EDGE students must submit all homework assignments electronically by the given deadlines. Exams must be received no more than four days after the in-class exam date. Please scan documents as a pdf and submit them electronically or via fax. We will use the department established proctoring for taking exams. You must follow-up and verify that exams are received in their entirety by the instructor. If problems occur, they must be reported early. No credit will be given for late submissions.

Exam Conflicts with other course exams

The official UF policy on exam conflict resolution states that when two exams conflict, the course with the higher number will take priority. There will be no exceptions to this rule.

Make-up exams

You only need 3 out of 4 exams. If you take all four exams, then your lowest exam score will be dropped. You do not have to take the 4th exam if you are satisfied with the scores of the first three exams. There is no disadvantage or penalty for not taking one exam.

Makeup exams will be provided only with the **prior approval of the instructor following university policies** (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx). In general, acceptable reasons for excused absence from an exam include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, and religious holidays. In all cases, you will be required to provide written documentation and obtain prior instructor approval. You will not be excused from any exam without following the policy above, with no exceptions. Students not in attendance for the scheduled exam will receive a score of zero. **You must notify the instructor of your intent and justification for missing the exam no less than one week from the scheduled exam.** Make-up exams for excused absences as well as exam conflicts must occur within one week of the missed exam and may occur before the missed exam.Grading

Grades will be based on your understanding and mastery of the material as demonstrated by the exams, quizzes, and homeworks.

Homework	15%
Online quizzes	10%
Best 3 out of 4 exams	75% (25% each)

You have two weeks after the test results are posted to resolve any questions about scores and grades. No changes to your exam grade will be made after that time.

Grading Scale

Percentage	≥92	≥88	≥84	≥80	≥76	≥72	≥68	≥65	≥62	≥59	≥56	<56
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0

In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:
http://gradcatalog.ufl.edu/content.php?catoid=5&navoid=1054#grades.

Office Hours

Office hours are Tuesday afternoons 2-3 pm. TA office hours Thursday afternoons from 2 to 4 pm. If you have any questions about the class or homework, please come to office hours or email me and the TA's. We will try to respond to e-mail questions as fast as possible. Important e-mail questions (minus identifying information) and answers may be posted to the class either by e-mail or on the course website for the benefit of other students.

Honesty Policy

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

See general regulations in the 2017-2018 graduate catalog section on academic integrity http://gradcatalog.ufl.edu/content.php?catoid=11&navoid=2486

Accommodation for Students with Disabilities

Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting an accommodation.

UF Counseling Services

Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

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.

Software Use

All faculty, staff, and student 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 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.

Week	Class dates	Topics	Book chapter
1	August 20 August 22 August 24	Video lectures Introduction of Thermodynamics Structure of Thermodynamics	1 2
2	August 27 August 29 August 31	Review of video lectures The Four Laws	1-2 3
3	September 5 September 7	The Four Laws	3
4	September 10 September 12 September 14	Video lecture: Thermodynamic Variables and Relations Review of video lecture	4
5	September 17 September 19 September 21	Review 1st Exam	1-4
6	September 24 September 26 September 28	Equilibrium	5
7	October 1 October 3 October 5	Statistical Mechanics	6
8	October 8 October 10 October 12	Unary Phase Diagrams	7
9	October 15 October 17 October 19	Review 2nd Exam	5-7
10	October 22 October 24 October 26	Partial Molar Quantities	8
11	October 29 October 31	Construction of Phase Diagrams	9
12	November 5 November 7 November 9	Construction of Phase Diagrams Thermodynamics of Phase Diagrams	9 10
13	November 14 November 16	Review 3rd exam	8-9
14	November 19	No class	
15	November 26 November 28 November 30	Thermodynamics of Phase Diagrams Reactions/Oxidation	10 11
16	December 3 December 5	Review 4th exam	10-11