

**Energetics & Kinetics**  
EMA 4314 Section 8797  
**Class Periods:** T 6, R 6-7  
**Location:** T – LIT 0121  
R – FLG 0260  
**Academic Term:** Fall 2017

**Instructor:**

Name: Brij M. Moudgil

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Office Hours: TBD, Particle Science & Technology Building room 205E (for appointment, contact Ms. Hollie Starr, Administrative Support Assistant 1 at [hstarr@ufl.edu](mailto:hstarr@ufl.edu); Ph: 352-846-1194).

**Teaching Assistants:**

Please contact through the Canvas website

- Jiaqi Dong, 561-267-0177, Particle Science & Technology Building room 205, Office Hours: TBD, [jiaqido1g@ufl.edu](mailto:jiaqido1g@ufl.edu)

**Course Description**

Foundations of energetics and kinetic theory with applications to processes in materials science (3 credits)

**Course Pre-Requisites / Co-Requisites**

Prerequisites: EMA 3010

Corequisites: None

**Course Objectives**

The objective of this course is to develop and understand the foundations of thermodynamics and kinetics of materials, including both the underlying physical principles and problem solving for materials problems.

**Materials and Supply Fees**

None

**Professional Component (ABET):**

2 credits associated with mathematics or basic science, 1 credit associated with engineering. Course does not contain a significant design component.

**Relation to Program Outcomes (ABET):**

This course addresses the following MSE Program outcomes:

- (1) Ability to apply knowledge of mathematics, science, and engineering to materials systems (high coverage).
- (6) Ability to identify, formulate and solve engineering problems (high coverage).

**Required Textbooks and Software**

- Physical Chemistry
- P.W. Atkins and J. de Paula
- Oxford, Part I, 9<sup>th</sup> Edition
- ISBN #1-4292-3127-0

**Recommended Materials**

- Thermodynamics, Statistical Thermodynamics and Kinetics  
T. Engel and P. Reid  
Prentice Hall, 2010, 2nd Edition  
ISBN #10: 0-321-61503-4

- Introduction to the Thermodynamics of Materials,  
D. R. Gaskell,  
4th Edition, Taylor and Francis, 2003  
ISBN #1-56032-992-0
- Thermodynamics in Materials Science,  
R. T. DeHoff,  
McGraw Hill (either 1st or 2nd Edition).

### **Course Schedule**

(Note: Section selection may change, some sections may be emphasized more than others)

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#### Class# 1-5

Topics:

Class overview, perfect gas laws, kinetic model, mixtures,  
Van der Waals and law of corresponding states

(Sections:

1.1-1.4)

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#### Class# 6-11

Topics:

Work, heat energy and internal energy  
Expansion work, heat transactions, Enthalpy, Adiabatic processes  
Standard enthalpy changes, Standard enthalpies of formation;  
T dependence

(Sections: 2.1 – 2.11)

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#### Class# 12-20

Topics:

Dispersal of Energy, entropy  
Entropy changes, Third Law, Gibbs and Helmholtz energies  
Standard molar Gibbs free energies  
Combined 1st and 2nd Laws, Properties of Gibbs Free energy

(Sections: 3.1 – 3.9)

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#### Class# 21- 30

Topics:

Phase diagrams, phase boundaries, phase rule, representative unary  
phase diagrams, phase stability, Phase boundaries, Ehrenfest classification.

(Sections: 4.1 – 4.6)

Mixtures: partial molar quantities, thermodynamics of mixing, chemical  
potentials

Liquid mixtures; Phase diagrams, Activity, Chemical equilibrium

(Sections: 5.1 – 5.13)

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#### Class# 31-43

Gibbs free energy, Temperature and pressure effects

Electrochemistry: half reactions and cells;  
cell potential, standard electrodes, Applications of cells

(Sections: 6.1-6.9)

Diffusion: (Sections: 20.8-20.10)

Homeworks will be assigned weekly.

Tentative Exam schedule is as follows: Exam 1 – Week of September 19; Exam 2 – Week of October 17; Exam 3 – Week of November 28.

(Optional: Unannounced tests may be given in class that could add up to 5 extra points to the total)

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Attendance in class is important. Material covered in class will follow the book closely in some areas and will deviate from it in others; in a few cases class notes will be used exclusively. In addition, there may be assignments to be completed in class that will count towards your grade. Those students not in class for any reason are responsible for the material covered in class, and the homework assigned.

Correct behavior in class is always important. Making noise, talking, reading the paper, leaving your cell phone on, leaving early or arriving late can be very distracting. Occasionally, your schedule will demand that you arrive late or leave early - in these cases please minimize class disruption.

Homework will be assigned and is due on the dates indicated on the HW assignments; no late homework will be accepted. Talking with others is encouraged, but all turned in problem solutions must be your own work. All homework problems and solutions may be downloaded from the e-learning site.

Exams: will closely follow the material covered in class, in your assigned reading and in homework problems. These will be closed book and without notes and will be given during a regular class period. A double sided one page (8.5X11 inch) listing equation/formulae etc. will be allowed. Requests for re-grading of exams must be made within one week after an assignment has been returned. Only exams completed in pen will be considered for re-grading.

Final Exam: There will be no final exam.

On the Web: This course will use Canvas (<https://lss.at.ufl.edu>). All class handouts, homework problem sets, homework solutions, exam solutions, and grades will be available throughout the semester.

This statement is required: Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets (7-8)	50 each	5%
Best of three exams (1)	100	45%
Next two best exams (2)	100 each	25% each = 50%
Total		100%

(Optional: Unannounced tests may be given in class that could add up to 5 extra points to above total)

Make-up Exam Policy: If you miss an exam through documented illness or for an excused absence, you may take a make-up exam. If you miss an exam for any other reason, you will receive a zero on that exam. No make-up quiz will be given for unexcused absence from an optional unannounced quiz.

### ***Grading Policy***

The following is given as an example only.

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
92 - 100	A	4.00
88 - 91	A-	3.67
84 - 87	B+	3.33

80 – 83	B	3.00
76 – 79	B-	2.67
72 – 75	C+	2.33
68 – 71	C	2.00
67 – 65	C-	1.67
62 – 64	D+	1.33
59 – 61	D	1.00
56 – 58	D-	0.67
< 56E	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 feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/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.

### ***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:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**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](mailto: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](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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