Title: Thermodynamics of Materials  
http://web.rutgers.edu/nanostructures/

Course: 14:635:206  
Section: 01/MTh11:30-12:50 PM  
Location: ARC-107, Busch  
Instructors: Dr. Thomas Tsakalakos

Contact Information:  
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Office Hours: Tues 2:30-3:30  
Thurs 2:30-3:30  
A-100 Eng Building

Computer Requirement: Some classes will be held at the Design, Simulation and Visualization (DSV) Computer Lab in room B-127 in the Engineering Building. All students are required to set up an account prior to the first computer session.


Description:  
Thermodynamics for Materials provides an overview of behavior of matter. In Materials science and engineering the thermodynamic matter is usually chemical reaction systems. Thermodynamics is one of the engineering sciences used in the design and analysis of processes. This course covers the basics of thermodynamics, and gives many examples for applying it to materials processing.

Objective:  
The objective of Thermodynamics for Materials is to expose the student the relationships which exist between equilibrium state and the external influences which are brought to bear on the system. Thermodynamics is one of the engineering sciences used in the design and analysis of processes. This course covers the basics of thermodynamics, and gives many examples for applying it to materials processing. The examples and exercises in this course have sometimes been simplified in order to make the calculations manageable. Students will develop an understanding of how the effect of the environment will influence the state of rest (equilibrium) of a given system. Problems will be presented in a manner to provide students with their first exposure to real world challenges.

Course Description/Outline: Material covered in this class will include the following:

1. Introduction and Definition of Terms  
2. The First Law of Thermodynamics  
3. The Second Law of Thermodynamics  
4. The Statistical Interpretation of Entropy  
5. Auxiliary Functions  
7. Phase Equilibrium in a One-Component System  
8. The Behavior of Gases  
9. The Behavior of Solutions  
10. Gibbs Free Energy Composition and Phase Diagrams of Binary Systems  
11. Reactions Involving Gases  
12. Reactions Involving Pure Condensed Phases and a Gaseous Phase  
13. Reaction Equilibria in Systems Containing Components in Condensed Solution  
14. Electrochemistry

Grading:  
12 Homework Assignments  25%  
2 Quizzes  5%  
Midterm  30%  
Final  40%
Homework:

- A lot of weight is placed on homework. If you have troubles, come ask!! BUT only after the effort has been made.
- Torn out paper edges are not acceptable – use real paper.
- Use a pen.
- Use staples and paper clips when necessary.

Problem Solving:

- Homework – try even if you get stuck, move on, return, etc.
- Don’t wait till the night before.
- List quantities asked for and relevant info given to you.
- Draw a picture, schematic, etc to help you visualize problem.
- Consider laws, definitions, equations.
- What are the unique conditions to a problem?
- Be sure relations you use are appropriate.
- There may be intermediate steps to solve.
- Put down all steps and assumptions used.
- Make sure you answer all questions asked.
- Think about answer units and sign

Attendance:
Attendance is mandatory! Attendance will be taken each class. A student will be allowed 2 unexcused absences, after which the student’s final grade will drop 5% for each additional class missed. Students will be excused without penalty from class because of a religious observance

Policy on Calculators:
Students will only be allowed to use a simple, four function calculator on quizzes and exams. Multifunction calculators with advanced memory capabilities will not be allowed to be used on quizzes or exams. Students should see the Instructor prior to a quiz or exam if there is any confusion with this policy.

Policy on Other Electronic Devices:
The use of cell phones, pagers, walkman or any other electronic device that may disrupt the class is not permitted. Students are encouraged not to bring these devices to class. If it is necessary to bring a device to class, it must be turned off or muted.

Academic Integrity:
Students will be expected to adhere to the Policy on Academic Integrity listed within the New Brunswick Undergraduate Catalogue. Students are encouraged to review this policy.

Contribution of Course to Meeting the Professional Component of ABET:
Thermodynamics is one of the engineering sciences used in the design and analysis of processes. This course covers the basics of thermodynamics, and gives many examples for applying it to materials processing

Relationship of Course to Program Objectives:
Thermodynamics for Materials develops an integrated understanding of properties, processing and the structure of materials used in materials applications. Students will see how materials affect the performance of materials components through demonstrations in class.