

Course Outline

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Office: Room 456 Tiernan Hall

- Course schedule: Wednesday 6:00 - 9:00 PM in FMH 206 (3 Credits)
- Office hours – By appointment
- Course web page is at moodle.njit.edu
- Assignments are due each week at the beginning of class
- Textbook: *Introduction to the Thermodynamics of Materials* (5th Edition) by D. R. Gaskell

Course Description

This course explores materials and materials processes from the perspective of thermodynamics. The laws of thermodynamics, solution theory and equilibrium diagrams are discussed.

Learning Outcomes:

By the end of the course, the student must be able to do the following:

Understand the concept of equilibrium, material properties, and equations of state.

Apply the laws of thermodynamics for the construction of single and multicomponent phase diagrams.

Read and make sense of the scientific literature that addresses and/or uses thermodynamic concepts to describe, model, or engineer material properties and processes.

Develop expertise on the mathematics of thermodynamic systems. Examples:

Formulate differential expressions that comply with the laws of thermodynamics. Develop an ability to

apply Maxwell relations to establish mathematical expressions between the different thermodynamic

quantities. Apply the concept of homogeneous functions, Gibbs-Duhem relation, etc., to construct

equations of state that are first-order homogeneous functions. Understand the reaches and limitations of

the ideal gas equation of state and the Van der Waals equation of state as models to describe real gases.

Grade Items

Homework	20%
Exam 1	30%
Exam 2(Final)	30%
Presentation Project	20%

Class Project Details

Choose a paper among the list of research project papers that will be posted on the course web page.

Give a presentation on the selected research paper and write a report on the presentation.

Presentations are about 15 -20 minutes followed by a short question/answer period.

Write a report on your presentation.

Week 1	Chapter 1: Introduction and Definition of Terms
	Chapter 2: The First Law of Thermodynamics
Week 2	Chapter 3: The Second Law of Thermodynamics
Week 3	Chapter 4: The Statistical Interpretation of Entropy
Week 4	Chapter 5: Auxiliary Functions
Week 5	Review
Week 6	Exam 1
Week 7	Chapter 6: Heat Capacity Enthalpy, Entropy and the Third Law of Thermodynamics
Week 8	Chapter 7: Phase Equilibrium in a One-Component System
Week 9	Chapter 8: The Behavior of Gases
Week 10	Chapter 9: The Behavior of Solutions
Week 11	Chapter 10: Gibbs Free Energy- Composition and Phase Diagram of Binary Systems
Week 11	Chapter 11: Reactions Involving Gases
Week 12	Review
Week 13	Presentations
Week 14	Presentations

Homework Problems

- HW 1 - Problems 2.2, 2.3, 2.4, and 2.7
- HW 2 - Problems 3.1, 3.3, 3.4 and 3.5
- HW 3 - Problems 4.1, 4.3 and 4.4
- HW 4 - Problems 5.1, 5.5, 5.10 and 5.12
- HW 5 - Problems 6.1, 6.2, 6.8, 6.9 and 6.10
- HW 6 - Problems 7.1, 7.2, 7.4, 7.7 and 7.8
- HW 7 - Problems 8.1, 8.3, 8.4 and 8.7
- HW 8 - Problems 9.1, 9.2, 9.3 and 9.5