

Fall 2023

## MTSE 602 - 101: Thermodynamics of Materials

Trevor Tyson

Follow this and additional works at: <https://digitalcommons.njit.edu/phys-syllabi>

---

### Recommended Citation

Tyson, Trevor, "MTSE 602 - 101: Thermodynamics of Materials" (2023). *Physics Syllabi*. 568.  
<https://digitalcommons.njit.edu/phys-syllabi/568>

This Syllabus is brought to you for free and open access by the NJIT Syllabi at Digital Commons @ NJIT. It has been accepted for inclusion in Physics Syllabi by an authorized administrator of Digital Commons @ NJIT. For more information, please contact [digitalcommons@njit.edu](mailto:digitalcommons@njit.edu).

# Thermodynamics of Materials (MTSE 602)

## Course Outline

Prof. Trevor A. Tyson

E-mail: [tyson@njit.edu](mailto:tyson@njit.edu)

Tel: 973-642-4681

Office: Room 484 Tiernan Hall

- Class will meet on Monday from 6:00 to 9:00 PM in Faculty Memorial Hall Room 108
- (3 Credits)
- Office hour is Monday from 5:00 to 6:00 PM (or by appointment)
- Class WWW page can be found at <http://web.njit.edu/~tyson/mtse602.html> (under construction)
- Assignments are due each week at the beginning of class
- Textbook: *Introduction to the Thermodynamics of Materials (6<sup>th</sup> Edition)* by D. R. Gaskell and D. E. Laughlin
- Supplementary Texts:
  - (1) *Thermodynamics of Materials* Vol I and II, by D. V. Ragone (Wiley)
  - (2) *Thermal Physics* by C. Kittel and H. Kroemer (2<sup>nd</sup> Edition, Freeman)
  - (3) *Thermodynamics* by E. Fermi (Dover)
  - (4) *Physical Chemistry* by R. A. Albert and R. A. Silbey (3<sup>rd</sup> Edition, Freeman)
- Study Guides:
  - (1) Schaum's Outline Series: *Thermodynamics* (2<sup>nd</sup> Edition, McGraw-Hill)
  - (2) *REA's Problem Solvers: Thermodynamics* (REA)

### Grade Decomposition

Homework	10%	<b>(Posted on the class website, after lectures)</b>
Quizzes	10%	
Exam I	10%	
Midterm Exam	20%	
Final Exam	25%	
Class Project	25%	

### Grade Cutoffs

87% – A

82% – B+

72% – B

65% – C+

55% – C

45% – D

Below 45% – F

### Class Project Details

Find paper relevant to material covered in class

Read and research paper (look-up references)

Present paper in class in 15 min. talk

Write 7 page report (1.5 space, not including figures)

See list of research project papers on main class WWW page

## Extra Credit Project

Students can obtain 4% extra credit towards the total score (100%) by submitting an experimental or modeling project at the same time as the final exam. The outline of the project is given below. We can discuss the project before you start it.

1. The experiments or modeling should cover the topics listed in the syllabus of the class
2. Students are expected to conduct original experiments or original modeling work (ask your research advisor for assistance)
3. A theoretical foundation with references should be given as part of the write-up (10-page write-up including figures)
4. The project should be independent and distinct from the class presentation and paper

Examples include (but not limited to these items):

- a. Multicomponent alloy or oxide synthesis
- b. DSC or specific heat measurements
- c. Modeling, machine learning, or data analysis of chemical processes

***Honor Code Violations or Disruptive Behavior:*** NJIT has a zero-tolerance policy for cheating of any kind and for disruptive student behavior. Violations will be reported to the Dean of Students. The penalties range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT. Avoid situations where your own behavior could be misinterpreted as dishonorable.

- **Students are required to agree to the NJIT Honor Code on each exam and quiz.** By taking an exam or quiz you agree to abide by the code.

Turn off all smart and cellular phones, wireless devices, computers, and messaging devices of all kinds during classes and exams. Please do not eat, drink, or create noise in class that interferes with the work of other students or instructors.

**Homework problems are posted on the class web site**

TOPIC	TEXT STUDIES
Week 1 (Sept. 11 to Sept 17) Introduction and Definition of Terms The First Law of Thermodynamic	Chapter 1 Chapter 2
Week 2 (Sept. 18 to Sept 24) The Second Law of Thermodynamics	Chapter 3
Week 3 (Sept. 25 to Oct. 1) The Statistical Interpretation of Entropy	Chapter 4
Week 4 (Oct. 2 to Oct. 8) Fundamental Equations and Relationships	Chapter 5
<b>Exam I (Oct. 9)</b>	
Week 6 (Oct. 9 to Oct. 15) Heat Capacity Enthalpy, Entropy, and the Third Law of Thermodynamic	Chapter 6
Week 7 (Oct. 16 to Oct. 22) Phase Equilibrium in a One-Component System	Chapter 7
Week 8 (Oct. 23 to Oct. 29) The Behavior of Gases	Chapter 8
Week 9 (Oct. 30 to Nov. 5) The Behavior of Solutions	Chapter 9
<b>Midterm Exam (Nov. 6)</b>	
Week 10 (Nov. 6 to Nov. 12) Gibbs Free Energy- Composition and Phase Diagram of Binary Systems	Chapter 10
Week 11 (Nov. 13 to Nov. 19) Reactions and Transformation of Phases	Chapter 11
<b>Last Day to Drop Class- Nov. 13</b>	
Week 12 (Nov. 20 to Nov. 26) Reactions Involving Pure Condensed Phases and a Gaseous Phase	Chapter 12
<b>Thanksgiving Recess- Nov. 23 to Nov. 26</b>	
Week 13 (Nov. 27 to Dec. 3) Reaction Equilibria in Systems Containing Components in Condensed Solution	Chapter 13

Week 14 (Dec. 4 to Dec. 10) Thermodynamics of Phase Transformations	Chapter 15
<b>Reading Days:</b>	Dec 14 and Dec. 15
<b>Final Exam Period:</b>	