# ME/MS 505 Materials Thermodynamics

The laws of thermodynamics; general formulation and applications to mechanical, electromagnetic and electromechanical systems; thermodynamics of solutions, phase diagrams; thermodynamics of interfaces, adsorption; defect equilibrium in crystals; statistical thermodynamics, including ensembles, gases, crystal lattices, and phase transitions.

Required Text: Introduction to the Thermodynamics of Materials by David R. Gaskell, Prentice Hall (6th edition).

Reference Texts:

1. C.H.P. Lupis, Chemical Thermodynamics of Materials, Prentice-Hall, Englewood Cliffs, NJ.
2. D. Tabor, Gases, liquids, and solids and other states of matter, Cambridge University Press Syndicate, Cambridge
3. David Chandler, Introduction to Modern Statistical Mechanics, Oxford University Press, Oxford, New York.

| Lectures | Lecture Topic | |
|---|---|---|
| 1 | Introduction (First Law) | Chapter 1 |
| 2 | First Law (Continued) | Chapter 2 |
| 3 | Second Law,<br>Statistics of Entropy I | Chapters 3 |
| 4 | Statistics of Entropy II | Chapter 4 |
| 5 | Auxiliary Thermodynamic Functions<br>Chemical Potential, Maxwell's Relations | Chapters 5 |
| 6 | Heat Capacity, Enthalpy, Entropy<br>and 3rd Law I | Chapter 6 |
| 7 | Heat Capacity, Enthalpy, Entropy<br>and 3rd Law II | Chapter 6 |
| 8 | One Component Phase Diagrams I | Chapter 7 |
| 9 | One Component Phase Diagrams II | Chapter 7 |
| 10 | Treatment of Gas Mixtures I | Chapter 8 |
| 11 | Treatment of Gas Mixtures II | Chapter 8 and Notes |
| 12 | Treatment of Condensed Systems I | Chapter 9 |
| 13 | Treatment of Condensed Systems II | Chapter 9 and Notes |
| 14 | Binary Phase Diagrams I | Chapter 10 |
| 15 | Multi-component Phase Diagrams II | Chapter 10 and Notes |
| 16 | Gas Reactions | Chapter 11 |
| 17 | Gas-Condensed Phase Reactions | Chapter 12 |
| 18 | Multi-component reaction equilibria I | Chapter 13 |
| 19 | Multi-component reaction equilibria II | Chapter 13 |
| 20 | Binary Phase Diagrams (Composition-Temperature-Pressure Space) | Chapter 14 |
| 21 | Electrochemistry | Chapter 15 |