

ESG 302 Thermodynamics of Materials (Required)

Course Catalog description:

The basic laws and concepts of thermodynamics are elucidated, and the important thermodynamic relationships are systematically developed with reference to the behavior of materials. The thermodynamics of solids is discussed, including the thermodynamics of solutions and the calculation of reaction- free energies and equilibria in condensed phase reactions such as phase transformations, oxidation, and diffusion. [4 credits]

Pre- or Corequisite(s): ESG 198, AMS 161 **Advisory prerequisite:** AMS 261

Text(s) or other required material:

David R. Gaskell, Introduction to Thermodynamics of Materials, 3rd ed., Taylor & Francis, 1995, ISBN# 1560324325

Course learning outcomes: The student is expected to master the basic theory of equilibrium thermodynamics and how to apply the theory to problems in heat engines, chemical reactions, phase equilibria, refrigeration and electrochemistry.

Topics Covered:

Week 1. Definitions of Terms
Week 2. First Law of Thermodynamics
Week 3. Second Law of Thermodynamics
Week 4. Statistical Interpretation of Entropy
Week 5. Auxiliary Functions
Week 6. Heat Capacity, Enthalpy, Entropy, and the Third Law of Thermodynamics
Week 7. Phase Equilibria in a One- Component System
Week 8. The Behavior of Gases
Week 9. The Behavior of Solutions
Week 10. Free Energy- Composition and Phase Diagrams of Binary Systems
Week 11. Reactions Involving Gases
Week 12. Reactions involving Pure Condensed Phases and a Gaseous Phase
Week 13. Reaction Equilibria in Systems Containing Components in Condensed Solution
Week 14. Electrochemistry

Class/ Laboratory Schedule:

ESG	302	Thermodynamics of Materials	LEC	1	TUTH	2:20 PM	3:40 PM
			REC	R01	W	10:40 AM	11:35 AM
			REC	R02	W	11:45 AM	12:40 PM

Contribution of Course to **meet requirement of Criterion 5:** Most of the course is devoted to the theory and exposition of thermodynamics, with an emphasis on problem-solving. The theory is related to some current public issues such as water purification and energy use and discussions are held in class to address these issues.

Relationship of course to program outcomes:

Person(s) who prepared this description and date of preparation:Jonathan Sokolov 6/30/09