MATSCEN 2251 Thermodynamics of Materials

Course Description

To provide students with fundamental basis of three laws of thermodynamics, phase equilibria, reaction equilibria, solution theory, phase diagrams and electrochemistry.

Prior Course Number: MSE 401
Transcript Abbreviation: Thermodynamics
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Sophomore
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 2010; and Physics 1250 or 1260; and Math 1151 or 1161, and Chemistry 1210 or 1250, and enrollment as Matscen-BS student or Weldeng-BS student; or permission of instructor.

Exclusions: Not open to students with credit for BOTH MSE 401 and MSE 525
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: Yes
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: No

Subject/CIP Code: 14.3101
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
MATSCEN	Materials Science and Engineering

Course Goals

Students will learn basic concepts related to three laws of thermodynamics, phase equilibria, reaction equilibria, solution theory, phase diagrams and electrochemistry.
Students will learn to calculate a wide range of thermodynamic properties from a limted number of experimental data.
Students will learn how to determine stability of materials under a given condition.
Students will learn how to determine what reactions will or will not occur under a specified condition.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction: criterion for stability of materials, basic concepts, definition of processes and systems	3.0							
First Law and its applications	3.0							
Enthalpy and Heat capacity	2.0							
Calculation of enthalpy changes	3.0							
Entropy and the Second law	3.0							
Calculation of entropy changes	2.0							
Second law and free energy	3.0							
Stability diagrams and stability boundaries	4.0							
Thermodynamics of mixing and solution thermodynamics	6.0							
Phase diagrams including ternary and alloy phase diagrams	8.0							
Reaction equilibria	3.0							
Thermodynamics of electrochemistry	2.0							

Representative Assignments

One homework problem set will be assigned each week. This will consist of problems from a textbook and/or lecture notes.

Grades

Aspect	Percent
Homework and quizzes	30%
Midterm examination	30%
Final Examination	40%

Representative Textbooks and Other Course Materials

Title	Author
No textbook; Lecture notes and supplemental materials (posted on the web-page)	Lecturer
Reference Book; Introduction to the Thermodynamics of Materials (5th ed.), Taylor and Francis (2008).	D. R. Gaskell
Reference book; Thermodynamics of Materials Vol. I, MIT Press/Wiley (1995)	D. V. Ragone
Reference book; Chemical Thermodynamics (7th ed.), Wiley (2008)	I.M. Klotz and R.M. Rosenberg

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
*	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
*	c	An ability to design a system, component, or process to meet desired needs.
*	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.

Course Contribution		College Outcome
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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