MSE 345 – Thermodynamics

Credits and contact hours:	4 credits and 60 contact hours.
Indicate: math, basic science, engineering topic or other	Engineering topics
Instructor's or course coordinator's name:	Dr. Pierre Lucas, David Poirier
Textbook, title, author and year:	Thermodynamics in Materials Science, Robert DeHoff, 2nd Edition, Taylor & Francis 2006 Thermodynamics, Statistical Thermodynamics, & Kinetics, Thomas Engel, Philip Reid, 2nd Edition, Pearson 2010 Physical Chemistry, Peter Atkins, Julio De Paula, 9th Edition, Freeman 2010
Other Supplemental materials:	
2016-2022 catalog description:	Introduction to the laws of thermodynamics, entropy, free energy, and the concept of equilibrium as applied to materials for conventional and advanced technological applications.
Prerequisites:	CHEM 151, MATH 129 or consult department before enrolling
Co-requisites:	None
Required, Elective, or Selected Elective:	Required
Instruction Outcomes:	1. Develop an understanding and working knowledge of 1st and 2nd laws of thermodynamics. 2. Develop a working understanding of least square regression for data fitting. 3. Demonstrate an ability to read unary, binary, and ternary phase diagrams. 4. Develop ability to express any change in a thermodynamic state property of a single phase as a function of any other 2

state properties (DeHoff technique).
5. Demonstrate an ability to utilize the Gibb's Phase Rule as applied to phase diagrams and chemical equilibrium.
6. Develop an understanding and working knowledge of calorimetry.
7. Demonstrate an ability to conduct chemical equilibrium calculations, including temperature dependence of chemical reactions.
8. Develop the ability to use thermodynamic database to perform thermochemical calculations.

Student Outcomes –

Listed in Criterion 3 or any other outcomes are addressed by the course:

To produce graduates who can:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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Topics covered:

- Introduction and Definitions of Thermodynamic Variables (4)
- 1st and 2nd Law (2)
- DeHoff method (3)
- Heat Capacity, calorimetry and Thermochemistry (6)
- Clausius's Inequality and Unary Phase Diagrams (4)
- Partial molar quantities, chemical potential and colligative properties (4)
- Binary phase diagrams (7)
- Chemical Equilibrium and its Temperature Dependence (4)
- Activity and Electrochemistry (3)
- Electrochemical Devices (2)