



Course Syllabus: Thermodynamics & Equilibrium Processes - MSE 303

Division	Physical Science and Engineering Division
Course Number	MSE 303
Course Title	Thermodynamics & Equilibrium Processes
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	10:30 AM - 12:00 PM Mon Thu

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Frederic Laquai	frederic.laquai@kaust.edu.sa	+966128087243	3233, 5, Al-Kindi (bldg. 5)	Sunday, 2-4PM Wednesday, 10AM-12PM

Teaching Assistant(s)	
Name	Email
Ahmed Balawi	ahmed.balawi@kaust.edu.sa

Course Information	
Comprehensive Course Description	This course provides an overview of the fundamental concepts in thermodynamics and their application in Materials Science. The following topics will be covered: review of the laws of classical thermodynamics, thermodynamic processes and cycles (Carnot and others), ideal and real gases, basics of statistical thermodynamics, solution theory and mixtures of gases and liquids, phase equilibria in single-component, binary, and ternary systems, chemical equilibria, surface and interface thermodynamics, chemical kinetics, kinetic gas theory, and polymer thermodynamics.
Course Description from Program Guide	The course offers a modern fundamental understanding of the main concepts and practical applications of thermodynamics in materials science. The following major topics are discussed: review of the laws of classical thermodynamics, introduction to statistical thermodynamics phase equilibria, including phase diagrams, theory of solutions, chemical reactions involving gases and condensed matter, Ellingham diagrams, surface and interfacial phenomena, and thermodynamics at the nanoscale.
Goals and Objectives	Objective 1: The student will learn basic concepts of classical and statistical thermodynamics needed to understand thermodynamic principles and their application. Objective 2: The student will learn to read and interpret phase diagrams of single-component, binary, and ternary systems. Objective 3: The student will learn to solve basic thermodynamic problems.
Required Knowledge	MSE200 (Students might attend this course as co-requisite).
Reference Texts	1.) Physical Chemistry, Peter Atkins, Oxford University Press, Eighth Edition, 2006 2.) Introduction to the Thermodynamics of Materials, David R. Gaskell, Taylor & Francis, Fifth Edition, 2008 3.) Thermodynamics & Kinetics in Materials Science, Bokstein, Mendeleev, Srolovitz, Oxford, 2005
Method of evaluation	40.00% - Final exam 30.00% - Midterm exam 30.00% - Homework /Assignments

Nature of the assignments	Weekly homework - problem solving: typically 2-4 problems closely related to the topics of that week's lectures.
Course Policies	Attendance is mandatory; not handing back the homework in time will result in a "0" grade.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/29/2018	Course Overview and Math Basics
1	Thu 02/01/2018	Thermodynamic Processes
2	Mon 02/05/2018	Thermochemistry
2	Thu 02/08/2018	Fundamental Laws of Thermodynamics
3	Mon 02/12/2018	Thermodynamic Cycles
3	Thu 02/15/2018	Thermodynamic Cycles II
4	Mon 02/19/2018	Auxiliary Functions
4	Thu 02/22/2018	Auxiliary Functions II
5	Mon 02/26/2018	Real Gases
5	Thu 03/01/2018	Introduction to Statistical Thermodynamics I
6	Mon 03/05/2018	Introduction to Statistical Thermodynamics II
6	Thu 03/08/2018	Solution Theory and Mixtures I
7	Mon 03/12/2018	Solution Theory and Mixtures II
7	Thu 03/15/2018	Review of Topics
8	Mon 03/19/2018	Midterm Exam
8	Thu 03/22/2018	Midterm Exam Results and Discussion
9	Mon 03/26/2018	Phase Equilibria
9	Thu 03/29/2018	Single Component Phase Diagrams
10	Mon 04/02/2018	Spring Break
10	Thu 04/05/2018	Spring Break
11	Mon 04/09/2018	Binary Phase Diagrams
11	Thu 04/12/2018	Binary and Ternary Phase Diagrams
12	Mon 04/16/2018	Chemical Equilibria
12	Thu 04/19/2018	Surface Thermodynamics I
13	Mon 04/23/2018	Surface Thermodynamics II
13	Thu 04/26/2018	Reaction Dynamics I
14	Mon 04/30/2018	Reaction Dynamics II
14	Thu 05/03/2018	Kinetic Gas Theory
15	Mon 05/07/2018	Thermodynamic Processes in the Atmosphere
15	Thu 05/10/2018	Thermodynamics of Macromolecules
16	Mon 05/14/2018	Review of Topics / Problem Solving
16	Thu 05/17/2018	Review of Topics / Problem Solving II
17	Mon 05/21/2018	Final Exam
17	Thu 05/24/2018	Final Exam Results and Discussion

Note

The instructor reserves the right to make changes to this syllabus as necessary.