2016 Syllabus

Advanced Classical Thermodynamics

MIE 1101H

Department of Mechanical and Industrial Engineering

University of Toronto

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1 COURSE DESCRIPTION

A course in which the postulatory approach is used to develop the theory of thermodynamics. The postulates are stated in terms of a variational principle that allows them to be applied to systems subjected to fields, to phase transitions, and to systems in which surface effects are dominant. The thermodynamic stability of systems is examined and examples of stable, metastable and unstable systems are discussed.

2 COURSE OUTLINE

2.1 FORMULATION OF THERMODYNAMICS

Systems, Constraints, Equilibrium, Postulates

2.2 FUNDAMENTAL RELATION

Postulates Intensive Properties and their Physical Meaning

2.3 THE INDEPENDENT VARIABLES OF A THERMODYNAMIC SYSTEM

Euler Relation, Gibbs-Duhem Relation, Two phase system. Triple point.

2.4 CONSTRAINTS AND THE THERMODYNAMIC POTENTIALS

Legrendre Transformations; Helmholtz, Gibbs and Grand Interactions

2.5 THERMODYNAMICS OF SURFACE PHASES

Surface Tension and the Dividing Surface Approximation, Contact Angle, the Young Equation and nanoporous materials. Nucleation of a New Phase: Bubble and Droplet Formation Limitation of Continuum Thermodynamics

2.6 THERMODYNAMICS SYSTEMS IN FIELDS

Pressure predicted from thermodynamics in single phase and two phase system Surface tension, adsorption at solid-vapor interfaces, contact angles and wetting

3 REFERENCES

Class notes

Suggested Book

H. B. Callen, *Thermodynamics and Introduction to Thermostatistics* J. Wiley and Sons, NY (1985).

4 COURSE MARKS

Homework - 10%

Mid-Term Test - 40% — Tentative date for Mid-Term: November 2, 2016

Final Exam - 50%

5 LECTURES

Day: Wednesday

Time: 6:00 - 8:00 p.m.

Room: MC 306