ChE 63a Jan 2018 SYLLABUS

1. Introduction
   Historical
   Nature, Scope and Applications of Thermodynamics
   Terms: system vs. surroundings, closed system vs. control volume
   equilibrium, state variables, process, intensive vs. extensive
   ideal gas
   Pressure and relationship to momentum flux
   Temperature and the Zeroth Law of Thermodynamics,
   Temperature scales, Thermometry
   Volumetric Properties of Pure Fluids, Two p-v-T phase diagrams

2. First Law of Thermodynamics for Closed Systems
   Joule’s Experiments, definition of Internal Energy
   types of inernal energy
   preliminary statement of 1st Law
   Definition of Heat and final statement of 1st Law
   Types of work: shaft work, p-V work
   Illustrative examples of p-V work
   Reversible and irreversible processes and relation with work
   Enthalpy: definition and illustrative examples for closed systems

3. First Law for Control Volume (Open Systems)
Derivation and origin of enthalpy flows
Examples: Compressors, Throttling devices, Flow through Valves, Vessel filling problems, Vessel emptying problem

4. Thermochemistry
Heat capacities as functions of temperature
Enthalpy of formation, enthalpy of reaction
First law applications to systems with chemical reactions

5. Entropy and the Second Law
Directionality of Processes, Reversible and Irreversible Processes
Statistical treatment of Entropy and the Second Law
Classical Treatment of Entropy and the Second Law, Kelvin-Planck and Clausius statements, Carnot Cycle, Clausius inequality, definition of entropy and statement of the second Law.
Calculations of $\Delta S$
Examples of second law applications

6. Power and Refrigeration Cycles
Rankin Cycle, Sterling Cycle
Internal Combustion Engines (Otto cycle, Diesel cycle)
Vapor Compression Refrigeration

7. Thermodynamic Property Relations
Fundamental Identities, Maxwell Relations
Calculations of $\Delta u$, $\Delta h$, $\Delta s$ from equations of state with $T,v$ and $T,p$ independent variables

Departure Functions

Joule Thomson Expansion and Liquefaction
ChE 63a Jan 2018 Homework Policy

Students are required to work out the solution of each problem in detail and neatly to allow easy grading by the TA. Exchange of information between students is allowed concerning the general approach to the problem solution, but the detailed derivation and calculations should performed by each student individually.

The grade will be based 30% on homework, 30% on the midterm, and 40% on the final.
ChE 63a Textbook and References

1. **Textbook: Koretsky Engineering and Chemical Thermodynamics**

2. C.B.P Finn: Thermal Physics

   Atkins: Physical Chemistry

4. Smith, Van Ness, Abbott: Introduction to Chemical Engineering Thermodynamics

References 1-4 will be on reserve in SFL