# Chemical Engineering Thermodynamics

Last Updated: Mon, 12/29/2025

**Course prefix:** CHBE

**Course number:** 2140

**Section:** A

**CRN (you may add up to five):**
2140

**Instructor First Name:** Julia

**Instructor Last Name:** Yang

**Semester:** Spring

**Academic year:** 2026

**Course description:**

Smith, Van Ness, et al. *Chemical Engineering Thermodynamics*, McGraw-Hill

**Course learning outcomes:**

At the conclusion of the course, students should have learned to:

1) Define complex thermodynamic systems including transient materials and energy balances for open and closed systems.

2) Be able to correctly use the First Law of Thermodynamics to find heat, work, and changes in internal energy and enthalpy for the analysis of any system, open or closed, undergoing irreversible processes.

3) Apply the Second Law of Thermodynamics and the concept of entropy production to the analysis of reversible and real systems.

4) Use equations of state for gases and liquids to determine changes in PVT properties. Understand the molecular concepts.

5) Understand the relationships among the interval energy, enthalpy, heat capacities, entropy, Gibbs and Helmholtz free energies.

6) Perform thermodynamic analysis of power and refrigeration cycles, and be able to calculate ideal efficiencies for these cycles.

7) Understand partial molar properties of components in a particular phase and apply to calculations of the heat of mixing, volume, and entropy changes on processing of idea and

real mixtures.

8) Understand the origin of chemical potential and fugacity

9) Determine the fugacity of a pure component non-ideal gas and of pure liquids and solids under high pressure.

10) Understand the molecular basis for ideal mixtures and calculate equilibrium phase compositions by relating chemical potential or fugacity to composition.

11) Calculate phase compositions for real mixtures at equilibrium based on EOS for gas phases, and activity coefficient models for non-ideal liquid or solid behavior.

12) Understand when phase equilibrium calculations require use of an EOS applicable to all phases, and perform such calculations using computer software.

13) Determine the equilibrium composition of single and multi-phase reaction mixtures, and how they are affected by temperature, pressure, composition, and other variables.

**Required course materials:**

Smith, Van Ness, et al. *Chemical Engineering Thermodynamics*, McGraw-Hill

**Grading policy:**

10% homework (all HWs weighted equally);
55% midterms (3 exams weighted equally);
35% final exam

There is no predetermined number of As, Bs, etc. Grade estimates are given after exams.

Concerns about assigned grades must be raised within a week of returning the graded work.

**Attendance policy:**

N/A

**Academic honesty/integrity statement:**

Students are expected to maintain the highest standards of academic integrity. All work submitted must be original and properly cited. Plagiarism, cheating, or any form of academic dishonesty will result in immediate consequences as outlined in the university's academic integrity policy.