CHBE 6100 Syllabus

Advanced Thermodynamics, 3 credit hours

Fall 2026

Instructor Information

Instructor: Corey J Wilson

General Course Information

Description

Equations of state, corresponding states, and activity coefficient models and their relationship to intermolecular forces. Phase and chemical equilibria in chemical engineering.

Course Learning Outcomes

By the end of the course, a student should be able 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 molecular concepts.

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

6) Perform thermodynamic analyses 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 ideal 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 of 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, including colligative properties.

12) Understand when phase equilibrium calculations require use of an EOS applicable to all phases.

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

14) Perform calculations of fluid properties and phase equilibrium of pure components and mixtures using computer software.

15) Understand how to use statistical thermodynamics to bridge quantum mechanics and macroscopic thermodynamics, using probability theory to relate molecular-level properties (microstates) to bulk thermodynamic properties.

16) Apply concepts from 1-15 to real-world problems.

17) Understand, interpret, and critically evaluate advanced thermodynamics topics from current primary literature.

18) Work in a team to propose and solve complex problems.

Required Course Materials

Smith, Van Ness, Abbott, Swihart
Introduction to Chemical Engineering Thermodynamics, McGraw Hill, 8th Ed.
ISBN: 1259696529

Sandler
An Introduction to Applied Statistical Thermodynamics
ISBN: 978-0-470-91347-5

Grading Policy:

In this course the following graded assessments and assignments are used to determine the course grade:

Quizzes / Mini Exams (in class + take home): 45%,

Literature Presentations and Q&A: 45%

Attendance & Participation: 10%

The letter grade cutoffs in this class are 90%+ for A, 80%+ for B, 70%+ for C, 60%+ for D, based on the overall score based on the relative weights above. These cutoff points may be lowered (resulting in a higher grade for some students) but will never be increased.

Course Policies

Attendance and/or Participation

Your academic success will depend strongly on the level of engagement with the course material. Actively participating in all lectures and taking advantage of other learning opportunities offered (e.g. assignments, office hours) is critical for successful attainment of the learning outcomes. The Georgia Tech Catalog describes policies around "approved Institute activities" (e.g., field trips and athletic events) and accommodations around religious observances.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Cases of suspected cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not applicable for this course.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.