

ME 7301 Transport Phenomena in Multiphase Flow

Fall 2026

Course Objectives and Learning Outcomes

To understand the thermodynamics, fluid flow and heat transfer aspects of interfacial phenomena, interface stability, dynamic behavior and phase transitions; boiling and condensation near immersed bodies; and convective boiling and condensation. The underlying physical phenomena will be emphasized with an introduction of the applications of these phenomena in Heat Transfer Equipment Design. This course is expected to be beneficial to engineers in the air-conditioning, chemical process, and power plant industries.

Credits/Pre-Requisites

3 Credit hours/Basic Heat Transfer. A sound background in thermodynamics, fluid mechanics and heat transfer will be assumed.

Instructor

Prof. Srinivas Garimella; E-mail: sgarimella@gatech.edu

Recommended Textbooks

V. P. Carey, Liquid-Vapor Phase-Change Phenomena: An Introduction to the Thermophysics of Vaporization and Condensation Processes in Heat Transfer Equipment, Third Edition, Taylor and Francis, 2020, <https://doi.org/10.1201/9780429082221>.

S. M. Ghiaasiaan, Two-Phase Flow, Boiling, and Condensation: In Conventional and Miniature Systems, 2nd Edition, Cambridge University Press, 2017.

Attendance and Participation

Classes are held in an interactive discussion format. While attendance is not mandatory and will not be recorded, students are expected to attend class regularly as well as to participate in class discussions. Class attendance is an important component of learning for success in this class.

Assignments

Most of the learning in this course will be accomplished through homework problems, short projects, and review of the current literature in this field. Projects will be assigned at appropriate stages of the course.

Grading

Homework: 60%; Mid-term: 15%; Final: 25%

Letter grade: A (90-100); B (80-89); C (70-79); D (60-69); F (<60)

The above scale reflects the guaranteed letter grades for the corresponding earned semester scores, with potential downward adjustments of the numerical score requirements borderline students and adjustments to account for potential higher degree of difficulty of any of the assessments during the semester.

Planned Topics

Phase Equilibrium, Interfacial Tension; Waves and Instabilities; Phase Stability, Homogeneous Nucleation; Heterogeneous Nucleation, Bubble Growth in Liquids; Pool Boiling; Film and Transition Boiling; Filmwise and Dropwise Condensation; Enhancement Phase-Change Heat Transfer; Two-Phase Flow; Convective Boiling Regimes, Subcooled Flow Boiling; Saturated Flow Boiling; Critical Heat Flux; Condensation in macro and microchannels; Boiling and Condensation of Binary Mixtures.

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.

Any student suspected of 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.

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 email me as soon as possible 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.