AE8803-ROM Syllabus – Fall 2026

Low-Gravity Fluid Mechanics, 3 Graduate Credits

General Information

Description

Introduction to low-gravity fluid mechanics and microgravity science and technology. Students will apply the theoretical tools taught during the first half of the semester to a final course project.

Pre- &/or Co-Requisites

Pre-requisite: AE4342 / 4321-22 or equivalent space systems engineering course

Others: A strong background in calculus, numerical methods, and fluid mechanics (e.g. AE6009 Viscous Fluid Flows) is highly recommended.

Course Goals and Learning Outcomes

Upon completion of this course, the student will:

- Understand the unique characteristics and operational environment of different microgravity facilities and their suitability for different research and technology demonstration payloads.
- Master the mathematical theory behind capillary flow statics, stability, and dynamics in low-gravity environments, together with the historical and state-of-the-art tools facilitating its implementation.
- Understand the challenges of low-gravity fluid control in key space technologies and state-of-the-art solutions in spacecraft design.
- Apply engineering design to produce solutions that meet specified needs with consideration of safety, technical constraints, and human factors. Understand the key trades in space fluidics design.
- Effectively communicate technical information in both oral and written formats

Instruction & Logistics

Instructor

Dr. Álvaro Romero-Calvo (alvaro.romerocalvo@gatech.edu), ESM 203B

Teaching Assistant

TBD

Schedule

Lectures: T (5 – 6:15 pm), R (3:30 – 4:45 pm), Howey Physics S106

Virtual meeting link: TBD

Office Hours

Instructor: R (5 – 5:45 pm), ESM 203B

TA: TBD

You're welcome to email the instructor and TAs during standard business hours. Include the TA in CC to your emails.

Course Requirements & Grading

Assignment	Date	Weight
Homework Assignments	See schedule on Canvas	35%
Weekly Quizzes	Issued after the last lecture of the week, due before the first lecture of the next week	10%
Midterm Exam	See schedule on Canvas	25%
Final Project Report	See schedule on Canvas	20%
Final Project Presentation	See schedule on Canvas	10%

This class does not have a final exam.

Extra Credit Opportunities

Extra credit assignments will be presented to the class on a case-by-case basis in addition to the regularly assigned work. Examples of possible extra credit assignments would be to conduct a more in-depth study of a particular topic, create new content and present it to the class, etc.

Description of Graded Components

Homework Assignments: Consists of regular assignments scheduled throughout the semester. Each assignment is based on the material covered in class.

- Release and due dates are listed on Canvas.
- Any assignment turned in after collection is late. Late assignments may be turned in during the grace period (24 hours) for half credit. Any assignment turned in after this is not counted.
- Completed lab assignments will be submitted via Canvas as a single PDF file written in accordance with the writing guidelines discussed in class. Deductions will be made for improper formatting.

Quizzes: Weekly quizzes will be issued after the last lecture of the week, due before the first lecture of the next week. Quizzes cover fundamental concepts from the lectures as reflected by external resources.

Midterm Exam: An individual, in-person, paper and pencil midterm exam will be issued mid-semester. A two-page cheat sheet drafted by the student will be allowed for consultation. After releasing the written grades, the instructor will meet with each student separately for a follow-up oral exam covering the content of the written test. This follow-up will result in a ± 10 pts grade modification.

Group Project: The course content will be applied and expanded on a group project carried out during the second half of the semester. The students will be able to pick one among several topics proposed by the instructor.

Although, by default, every team member will get the same grade, the instructor reserves the right to modify individual grades by +-20 pts with respect to the baseline when the individual work carried out by the student exceeds or does not meet the expectations.

Grading Scale

The final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Full credit is awarded for solutions that demonstrate a solid understanding of the problem and mastery in the execution of the solution. Partial credit is given for solutions that, while incorrect, demonstrate partial knowledge. Final grades will not be curved.

Course Materials

Textbooks

- Recommended:
  - D. Langbein, "Capillary Surfaces – Shape, Stability, Dynamics, in Particular Under Weightlessness", Springer, 2002
  - A.D. Myshkis, V.G. Babskii, N.D. Kopachevskii, L.A. Slobozhanin, A.D. Tyuptsov, "Low-Gravity Fluid Mechanics, Mathematical Theory of Capillary Phenomena", Springer, 1987
  - M. E. Dreyer, "Free Surface Flows under Compensated Gravity Conditions", Springer, 2007
- Key journals: npj Microgravity, Microgravity Science and Technology, Acta Astronautica, AIAA Journal (before 1980s), AIAA Journal of Spacecraft and Rockets
- Specific materials will be recommended on the lecture slides

Course Website and Other Classroom Management Tools

Course materials will be posted online to Canvas (https://canvas.gatech.edu/). Course materials (e.g. recorded videos) will be available to both in-person and distance learning sections. Important communications to the class will be sent through the Canvas system; please be alert to these messages. Students will be held responsible for any message or announcement that has been posted to the class for more than 24 hours.

Course Expectations & Guidelines

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 the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are required to report any suspected violation of the Honor Code to the Instructor whether or not they were directly involved in the incident.

Any student suspected of cheating or plagiarizing 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.

Use of Generative Artificial Intelligence (AI) Tools

As grad students, you are expected to develop independent, creative, and critical thinking. Reading the scientific literature and synthesizing its content is part of that training. In this context, you are welcome to use generative AI programs to help generate ideas and brainstorm. You are also welcome to use AI tools when explicitly allowed in the course assignments. You should be aware that the material generated by these programs may be inaccurate, incomplete, biased, or otherwise problematic. In addition, using these tools may stifle your independent thinking and creativity.

Generative AI derives its output from previously created texts from other sources that the models were trained on. Still, most of these tools don't cite sources. Per GaTech's Honor Code, you may not submit any work generated by an AI program as your own. The only exception is grammar/spell/style correctors.

Collaboration & Group Work

Discussions with other students about homework methods are allowed and encouraged; however, all work turned in must be the student's own original work.

Midterm and/or final exams must be completed individually.

The use of outside references (e.g., textbooks) is expected and encouraged as long as they are appropriately cited.

Use of homework solutions from prior semesters is not allowed, resulting in a 0 grade on the assignment and an honor code violation.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services 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.

Attendance and/or Participation

Classroom attendance, either in person or remotely, is strongly encouraged but not required. If you choose to join the lectures, active participation is expected. Attendance will also be considered by the instructor when assigning final grades near a letter-grade boundary. Any material covered in class is susceptible to being evaluated.

Absences related to personal illness or emergency, or career development (e.g., presenting a paper at a conference or scheduled job interview) are considered excused if approved by the **Dean of Students**. . Please contact the instructor as soon as you know of a schedule conflict. Please see the Institute Absence Policy - https://catalog.gatech.edu/rules/4/ for more information.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Assignments are due at the designated time using online submission on Canvas. Any assignment turned in after collection is late. Late homework assignments may be turned in during the advertised grace period (24 hours) for half credit. Any homework turned in after this is not counted. The grace period doesn't apply to quizzes, midterms, or presentations.

Excused absences (see above) may be a justification to receive an extension on an assignment. Please get in touch with the instructor as soon as you know of a schedule conflict, and before it occurs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulates some basic expectations that you can have of me and that I have of you. Additional information for research-related work is given in The Expectations of Advisors and Advisees. 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 Georgia Tech's ideals in this class.

Student Use of Mobile Devices in the Classroom

Mobile Devices (laptop computers and tablets) may be used in class to enhance your learning experience, provided they are used in support of the class and are not a distraction to you or your classmates. Viewing materials unrelated to the class and doing homework in class is not allowed. Cell phones should be set to silent mode and stowed during class. If you must answer a phone call during class, please step outside to avoid disturbing the class.

Course Schedule

The course schedule will be posted on Canvas in the first week of the semester. Changes to the outline will be discussed in class, and updated versions will be uploaded as necessary.