

AE-2699/2689/4689/4699 Syllabus

LGST Lab Undergraduate Research Opportunities, 2/3 Undergraduate Credits

Meetings: ESM 108, time TBD*

*unless indicated otherwise

Instructor Information

Instructor	Email	Office Location
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Graduate Assistant		
TBD	TBD	TBD

General Information

Description

This course offers undergraduate students the opportunity to conduct research at the Low-Gravity Science and Technology Laboratory (LGST Lab). Three projects are currently active:

- **Propellant Sloshing Group:** studies the sloshing of liquids in different types of containers and gravity levels. Students will carry out research in different teams, which will focus on (i) developing a state-of-the-art graphical user interface to study liquid sloshing, (ii) ground testing via slosh damping, (iii) suborbital rocket testing, and (iv) low-gravity sloshing payload development. New students will be trained in the basics of propellant sloshing before contributing to the overall research project.
- **Plant Chamber Group:** A 3-year 6-crewmember mission to Mars requires ~11,000 kg of food with an 18-20% packaging mass overhead. With launch costs of the order of 23,000 USD/kg, bioregenerative life support systems are widely regarded as a promising approach to reduce future upmass requirements and provide supplementary nutrients to the crew. Plant chambers seek to address the second objective, but existing designs onboard the International Space Station (ISS) are faced with multiple challenges associated with the lack of effective gravity and the need for reliable food production methods. The Plant Chamber Group will (i) design and build an ISS-like plant chamber with temperature, humidity, air, water, and light control, (ii) test spaceflight-compatible crops in preparation for future missions, (iii) develop novel hydroponic and porous plant watering systems for partial-gravity environments, and (iv) train environmental monitoring ML/AI algorithms using hyperspectral imaging. Students enrolled in this URO program will be asked to follow the NASA-standard design process to build their plant chamber.
- **Graduate-student-led projects:** managed by a graduate student, these projects focus on funded research efforts at the LGST Lab.

Pre- &/or Co-Requisites

Strong background in thermodynamics & fluids mechanics.

Course Goals and Learning Outcomes

Upon completion of this course, the student should be able to:

- Carry out independent research tasks individually or as part of a team
- Coordinate within and beyond their research group
- Learn the fundamentals associated with the corresponding research project
- Be able to communicate their findings in an organized, structured manner

Course Grading

Because this undergraduate research course combines multiple groups, each of them follows a different grading scheme:

New students in propellant sloshing:

- Homework assignments are designed to ramp up new researchers joining the project. Getting a >60% grade is a necessary condition to start the actual research effort.
- Homework assignments are due at the designated time using online submission on Canvas. **Any assignment turned in after collection is late.** Late lab assignments may be turned in under special circumstances.
- You are encouraged to ask your teammates (particularly, senior students) for help and advice while completing your individual assignments, but you must understand their content, run your own experiments, and submit your own report.
- Once all homework is submitted, you will contribute to regular bi-weekly research update presentations and participate in the Final presentation. The final presentation summarizes the research carried out during the semester. Each presentation is evaluated based on the quality and quantity of content for a 6h/week (2 credits) or 3h/week (3 credits) basis. Presentation grades are shared by sub-team members but may be modified by +/-15 points based on individual performance.
- Up to **two** research meetings can be missed without justification. Three missed meetings result in a 5% meeting attendance grade. Four or more result in a 0% meeting attendance grade.

Assignment	Date	Weight
Homework assignments	Weekly or bi-weekly until mid-semester (see Canvas)	40%
Status updates	Bi-weekly, after homework is finished	20%
Final presentation	Last days of the semester (see Canvas)	15%
Meeting attendance	All semester	10%
Peer evaluation	Last days of the semester (see Canvas)	15%

Senior students in propellant sloshing:

- No homework assignments are required from students who already completed them in a previous semester.
- Senior students are expected to lead by example and contribute the most to the different research projects, adopting project management roles.
- Senior students will lead the regular bi-weekly research update meeting and the kick-off and final presentations. The kick-off presentation sets the goals and deadlines for the semester, which will be continuously re-assessed during the bi-weekly meetings. The final presentation summarizes the research carried out during the semester. Each presentation is evaluated based on the quality and quantity of content for a 6h/week (2 credits) or 3h/week (3 credits) basis. Presentation grades are shared by sub-team members but may be modified by +/-15 points based on individual performance.
- Up to **two** lab meetings can be missed without justification. Three missed meetings result in a 5% meeting attendance grade. Four or more result in a 0% meeting attendance grade.

Assignment	Date	Weight
Kick-off presentation	First days of the semester (see Canvas)	15%

Assignment	Date	Weight
Status updates	Bi-weekly	40%
Final presentation	Late-Nov.	20%
Meeting attendance	All semester	10%
Peer evaluation	Dec. 1	15%

All students in plant chamber:

- Only Homework 1 (LaTeX report) needs to be completed.
- Homework assignments are due at the designated time using online submission on Canvas. **Any assignment turned in after collection is late.** Late lab assignments may be turned in under special circumstances.
- You are encouraged to ask your teammates (particularly, senior students) for help and advice while completing your individual assignments, but you must understand their content, run your own experiments, and submit your own report.
- All students will be evaluated based on bi-weekly, kick-off, and final presentations. The kick-off presentation sets the goals and deadlines for the semester, which will be continuously re-assessed during the bi-weekly meetings. The final presentation summarizes the research carried out during the semester. Each presentation is evaluated based on the quality and quantity of content for a 6h/week (2 credits) or 3h/week (3 credits) basis. Presentation grades are shared by sub-team members but may be modified by +/-15 points based on individual performance.
- Up to **two** research meetings can be missed without justification. Three missed meetings result in a 5% meeting attendance grade. Four or more result in a 0% meeting attendance grade.

Assignment	Date	Weight
Homework 1	First days of the semester (see Canvas)	10%
Kick-off presentation	First days of the semester (see Canvas)	10%
Status updates	Bi-weekly	35%
Final presentation	Last days of the semester (see Canvas)	20%
Meeting attendance	All semester	10%
Peer evaluation	Last days of the semester (see Canvas)	15%

All students working with graduate mentors:

- Only Homework 1 (LaTeX report) needs to be completed.
- Homework assignments are due at the designated time using online submission on Canvas. **Any assignment turned in after collection is late.** Late lab assignments may be turned in under special circumstances.
- You are encouraged to ask your graduate mentor for help and advice while completing your individual assignments, but you must understand their content and submit your own report.
- At the beginning of the semester, you need to upload to Canvas a "Semester expectations document" signed by you and your graduate student advisor where you describe your tasks for the semester

(divided between essential and nice-to-have), provide clear success criteria, and a proposed timeline. This statement of work (SOW) has to be commensurate with the number of credits you signed up for (with each credit requiring 3h/week of work).

- Your progress will be assessed by your graduate student mentor, who will guide you throughout the semester and report any issues to the instructor.
- At the end of the semester, you will summarize the research carried out during the year and present it at one of the LGST Lab group meetings. Your presentation will be evaluated based on your original semester expectations document.

Assignment	Date	Weight
Homework 1	First days of the semester (see Canvas)	10%
Semester expectations document	First days of the semester (see Canvas)	10%
Graduate student report	Last days of the semester (see Canvas)	40%
Final presentation	Last days of the semester (see Canvas)	40%

Extra Credit Opportunities

Extra credit assignments may be presented to the group on a case-by-case basis in addition to regularly assigned work. Examples of possible extra credit assignments would be to re-work missed problems, work optional additional homework problems, write a report on a topic that is relevant to the project, etc. Please contact the instructor if you want to discuss possible opportunities for extra credit.

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 are correct and demonstrate an understanding of the concepts of the problem. Partial credit is given for solutions that, while incorrect, demonstrate some knowledge of the concepts. Final grades are not rounded up.

Course Materials

Course Text

Sloshing: NASA SP-106 “The Dynamic Behavior of Liquids in Moving Containers”, F.T. Dodge’s “The New Dynamic Behavior of Liquids in Moving Containers”.

Course Website and Other Classroom Management Tools

Course materials will be posted online to Canvas (<https://canvas.gatech.edu/>) or provided directly by the graduate student mentor, if applicable. 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.

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

Group/coordination meeting attendance is required. Active participation is essential for understanding major concepts and contributing to the research effort.

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.

Collaboration & Group Work

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

The use of outside references (e.g. textbooks) is expected and encouraged; when appropriate, cite any referenced material that is used.

Use of solutions from prior semesters (if/when applicable) is not allowed, resulting in a 0 grade on the assignment and an honor code violation.

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. Assignments that are turned in late will have a portion of the grade deducted (10%) per day. Any assignment that is more than a week late without an accepted excuse is not counted.

Excused absences (see above) may be a justification to receive an extension on an assignment. Please contact the instructor as soon as you know of a schedule conflict if this applies to you. Extensions are not granted after the assignment due date has passed.

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) are allowed 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 during class is not allowed.** Cell phones should be set to silent mode during class. If you must answer a phone call during class, please step outside so as not to disturb the class.

Course Schedule

To be communicated in Canvas early in the semester based on student availability. This course does not have a final exam.