AE 2220 Dynamics & AE 2221 3D Dynamics

Fall 2026

Course description

Motion of particles and mass center of bodies, kinematics and kinetics of rigid bodies in plane motion, work-energy and impulse-momentum methods, 3-D dynamics of rigid bodies.

Prerequisite: COE 2001 – Statics, MATH 2552 – Differential Equations (co-requisite)

Why is this course required for AE students

Aerospace vehicles (aircraft, rockets, spacecraft, helicopters, drones) move us, our commerce, our technologies, and thus our dreams. To design effective and efficient aerospace vehicles requires us to understand their dynamics. At the end of the course, you will be able to derive, solve, simulate, visualize, understand, and communicate the dynamics of aerospace vehicles. The focus in this course will be on the inertial forces ($m \times a$ side of the $F=m \times a$) rather than the applied forces - aerodynamic and propulsion, which you will learn in detail in your aerodynamics and jet/rocket propulsion courses. We will start with translational dynamics of particles in 1D, then on to 2D/3D, and then on to (translational + rotational) rigid body dynamics first in 2D and then 3D.

Upon successful completion of the course, you will be able to

1. Identify the assumptions and the corresponding form of Equations of Motion (EoM) needed for a given Aerospace Vehicle (AV) on a given mission
2. Draw a Free Body Diagram and derive EoM that can be used for simulating the dynamics of AVs
3. Solve/simulate the EoMs to determine the dynamic response of the AVs
4. Visualize, explain, and communicate the solutions for dynamics of AVs which will help you improve your dynamics knowledge and insight, and which in turn will help you work on the design and development of AVs in the future
5. Register for, and have the foundational knowledge and skills for, follow-up courses in system dynamics, aircraft flight dynamics, spacecraft dynamics, and control system analysis, which will prepare you for a career in aerospace engineering

Instructor: Prof. Mayuresh Patil
Office Hours: TBD (Weber 211)
E-Mail: mpatil@gatech.edu
Office: Weber 211C

Undergraduate Teaching Assistant: TBD
Recitation Section: TBD
Office Hours: TBD

Graduate Teaching Assistant: TBD
Office Hours: TBD in Loewy Library

Website: Canvas will be used for all course related information.

Text: We will not use a textbook. Slides, codes, and class notes will be uploaded on Canvas.

Grading: ~10 Homework (20%), ~8 Mini-Projects (30%), 3 Tests (30%), Final (20%)
Scale = A: 90–100%, B: 80–89%, C: 70–79%, D: 60–69%, F: <60%

Attendance: Attendance is mandatory. You are allowed at most 3 unexcused absences, after which you will lose 1 point for each additional absence. Thus, 13 or more unexcused absences will lead to an attendance grade of 0 out of 10 and will definitely lead to a lower grade.

Please email me any excused absences. Excused absences are absences that you plan for (conference travel, work travel, health, family, academics, other aspects of your life which may take precedence occasionally) or absences due to emergencies (health, family, life …). You do not need to go through the Dean's office. Just an email is sufficient.

I want you to give appropriate priority to attending lectures regularly.

Well-Being: If you ever find yourself in any situation in which an unexpected personal challenge is preventing you from performing your best in the course, please reach out so we can come up with a plan for you.

Learning Accommodations: As needed, we will make classroom as well as testing accommodations for students with disabilities. These accommodations are typically arranged in advance with the Office of Disability Services (ODS) at https://disabilityservices.gatech.edu. I am happy to work with you to help you learn – please reach out.

Student-Faculty Expectations Agreement
https://catalog.gatech.edu/rules/21/

Georgia Tech Honor Code
https://policylibrary.gatech.edu/student-life/academic-honor-code