

ME6441 Syllabus

Dynamics of Mechanical Systems, Section A, 3 credits

Fall 2026

Instructor Information

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General Course Information

Description

Motion analysis and dynamic modeling of systems of particles and rigid bodies in three-dimensional motion. Kinematics topics include curvilinear coordinate systems, relative motion, angular velocity and acceleration, and constrained systems of rigid bodies. Kinetic principles include Newton-Euler (momentum-based) and Lagrange-Hamilton (energy-based) equations of motion, computational algorithms for solving constrained equations of motion, gyroscopic systems, general conservation theorems, and ignorable coordinates.

Course Learning Outcomes

1. Students will demonstrate an ability to describe the position, velocity, and accelerations of particles and rigid bodies in three dimensions
 - 1.1 Students will be able to use rotation matrices to describe the relative orientation of one body/frame relative to another.
 - 1.2 Students will be able to analyze the kinematics of mechanisms made up of several rigid bodies with various types of connecting arrangements including revolute joints, prismatic joints, and rolling contact.
2. Students will be able to apply Newton-Euler analysis techniques to rigid-body dynamics
 - 2.1 Students will be able to find inertia matrices for bodies of arbitrary shape and be familiar with principal axes for rigid bodies

2.2 Students will be able to apply Euler equations and Euler's laws of motion to rigid bodies and multi-body systems and be familiar with the gyroscopic effects of spinning rigid bodies

2.3 Students will be able to use the concepts of Work and Energy to solve for the motion of conservative and nonconservative systems and be familiar with conservation of energy laws

2.4 Students will be familiar with the impulse-momentum concept and with momentum conservation laws

3. Students will be able to use Lagrange's equations for mechanical systems

3.1 Students will be familiar with the concepts of holonomic and nonholonomic constraints

3.2 Students will be able to use Lagrange's equations to find the governing equations for unconstrained and constrained dynamic systems

3.3 Students will have an understanding of how equations of motion are solved numerically for constrained and unconstrained systems.

Required Course Materials

Engineering Dynamics, 3rd Edition, by J. H. Ginsberg, Cambridge 2008. Available at Amazon or the GT Bookstore.

Grading Policy:

Grades will be determined by two tests worth 25% each, a final exam worth 35%, and HW assignments that total 10% of your grade.

Final letter grades will be assigned based on a standard cutoff scale:

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

Description of Graded Components

All tests and exams will be closed-book and closed-notes with equation sheets provided. Tests and the final exam will be cumulative. Homework will be assigned almost every week, and some assignments will require computer simulations or numerical solutions.

At Georgia Tech, final course grades are awarded on a scale of A-F with no +/- grades permitted

Course Policies

Attendance

Attendance and participation are not required but are strongly encouraged. In the case of illness and/or family emergencies, it may be necessary for you to delay tests or you may need additional time to complete homework assignments. In these cases, please work with the Office of VP for Student Life (Dean of Students) with documentation that supports your situation. If the illness or family emergency is deemed serious enough, the Dean's office will then contact me and your other instructors with recommendations on how to proceed. Students who miss a deadline or test date because of participation in a particular religious observance will be permitted to make up the work missed during their absence with no late penalty, provided the student informs the instructor of the upcoming absence, in writing, within the first two weeks of class, and provided the student makes up the missed material within the established timeframe.

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

Additional Georgia Tech Required Policies

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.

Optional Course Expectations, Policies, and Resources

Pre- &/or Co-Requisites

An undergraduate experience in dynamics comparable to the curriculum of the Georgia Tech Mechanical Engineering program (e.g., ME 2202 Dynamics of Rigid Bodies or ME 3017 System Dynamics) is strongly recommended.

Collaboration, Group Work, and Use of Generative AI

Working in groups on homework assignments is allowed but each student must turn in their own work. Some assignments will be time-consuming and some will require computation (e.g., Matlab) to solve the problem and/or plot the results. The homework assignments are designed to help you to learn the material. Solutions to the homework will be posted to Canvas after the due-date is past; it is your responsibility to review these solutions in detail and to compare them with your returned homework.

Generative AI (GenAI) and other tools have tremendous capability and are growing in performance and availability every day. Engineers are increasingly using GenAI tools in industry as well as research and development. That being said, our goal in ME6441 is to learn the fundamental principles of dynamics so that you will be competent in being able to predict and design the motion of mechanical systems and to know the foundational principles of kinematics and kinetics. Engineers must not only know how to get an answer to a "textbook problem," but must understand which techniques to use, how and when to use different approaches, and the requirements and limitations of each method. Engineers must also understand the ethical and societal issues surrounding the work that they perform. GenAI, while powerful, does not always appreciate the nuances of various techniques, nor does it always give correct answers. Thus, the use of GenAI, like the use of any other educational resources, must be done responsibly in order to meet the course learning objectives. Overreliance on any learning resource may result in inadequate understanding of the material, and may hurt a student's performance on closed-book,

closed-note tests and exams. In the end, true understanding of engineering principles comes only through practice and experience, which I am committed to help you achieve.

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

HW assignments are due at 11:59pm on their respective due dates. These assignments may be turned in after the deadline, but you will be eligible for fewer points once the deadline has passed: Unless you have been granted an extension or accommodation, a late penalty of 10% will be assigned for each day that the HW is late. HW submitted after the solution has been posted will receive a 50% late penalty. Make-up exams are given for illness, approved Institute activities or religious observances.

Campus Resources for Students

Graduate Student Academic and Professional Success Resources:

A list of resources for graduate students is given on the [Office of Graduate and Postdoctoral Education](#) website. Specific information for [current graduate students](#) includes

- [Academic Resources](#) such as the Communications Center, Language Institute, Library, Catalog, Registrar, resources for conducting research, Advocacy and Conflict Resolution resources, and how to manage unexpected situations that may impact your academic performance;
- [Student Resources](#) such as Campus Services, Child Care/Family programs, Health & Wellness, Career Services, and the Student Resource Guide; and
- [Professional Development](#) such as *the programming from the Career Center and other professional development resources and events*"

Student Well-Being:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, depression, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. GT offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know is experiencing any of the issues noted above, consider utilizing the confidential mental health services available on campus. I encourage you to reach out to GT CARE (www.care.gatech.eduLinks to an external site., 404-894-3498) or the Counseling Center (www.counseling.gatech.eduLinks to an external site., 404-894-2575) for support. An on-

campus counselor or after-hours services are available to assist you. More resources on supporting student well-being on the syllabus and beyond are available through the [Learning Well Initiative](#).