

ME 314: Theory of Machine Dynamics

Syllabus

Prof. Todd Murphey
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09/20/2022

Location: Tech L361

Time: MTWF 9:00-9:50 AM

URL: The Canvas suite at <https://canvas.northwestern.edu/>

Instructor Office Hours: Monday 10 AM, online

TA: Jake Ketchum (jakeketchum2025@u.northwestern.edu)

TA Office Hours: Likely times: Monday 4-5 PM, Tuesday 10-11 AM, Thursday 12:00-1:00 PM

Exam: Weekly assessments on Wednesdays.

Textbook: There is no required textbook; the course notes will be available online.

Software: Required: *python* will be used, available for free as download and in Colab-latory (<https://colab.research.google.com>) which is freely available through student google accounts.

Course Description: This class covers the foundations of rigid multi-body mechanics. Topics include geometry of rigid bodies, rotating bodies, Lagrangian mechanics and variational principles, conservation of energy and momentum, symmetries, impact dynamics, and numerical methods that may be used to simulate mechanical systems. Students numerically simulate rigid body systems and use rigid body geometry to visualize simulations.

Prerequisites: Engineering Analysis IV

The class outline is roughly as follows.

	Topic
1	Calculus background and $F = ma$
2	Dynamics of point masses and variational principles
3	Conservation of energy and momentum and collisions
4	Lagrangian mechanics
5	Lagrangian dynamics with constraints and external forcing
6	Rotating bodies and angular momentum
7	Creating and evaluating numerical methods
8	Geometry and kinematics
9	Using Geometry and kinematics in Lagrangian mechanics

Testing, Homework, Grading

Grading will nominally be based on the following.

Homework:	50% of total grade.
Weekly Assessments:	25% of total grade
Final Project:	25% of total grade.

Note that there will be no final exam and that a final project will take its place.

Disability Accommodation

If you qualify for accommodations because of a disability, please submit a letter to me from Northwestern's Disability Services in a timely manner so that your needs may be addressed. Please see <https://www.northwestern.edu/accessiblenu/> for more information.

Learning Environment, Diversity, and Inclusion

We should all maintain a good learning environment for everyone. Such a learning environment includes treating each other with respect, knowing that we all contribute to learning. Moreover, we all have something to learn from each other. This part of a syllabus runs the risk of sounding insincere and patronizing, but I want students to know that I take this very seriously. Engineering as a discipline needs people from all backgrounds, and needs to made up of people of all identities, in order to serve society and promote well being.

Academic Integrity

Don't cheat or do anything you might be upset about if someone else did it. You can find a full explanation of Northwestern's and McCormick's policies on academic integrity at <http://www.northwestern.edu/uacc/>.

Students in this course are required to comply with the policies found in the booklet, "Academic Integrity at Northwestern University: A Basic Guide". All papers submitted for credit in this course must be submitted electronically unless otherwise instructed by the professor. Your written work may be tested for plagiarized content. For details regarding academic integrity at Northwestern or to download the guide, visit:

<https://www.northwestern.edu/provost/policies-procedures/academic-integrity/index.html>

Coming out of the Covid-19 Pandemic Hopefully Covid-19 policies will not affect us this year, but please be aware of university expectations.

Students, faculty and staff must comply with University expectations regarding appropriate classroom behavior, including those outlined below and in the COVID-19 Expectations for Students. With respect to classroom procedures, this includes:

- 1. Policies regarding masking, social distancing and other public health measures evolve as the situation changes. Students are responsible for understanding and complying with current University, state and city requirements.*
- 2. In some classes, masking and/or social distancing may be required as a result of an Americans with Disabilities Act (ADA) accommodation for the instructor or a student in the class even when not generally required on campus. In such cases, the instructor will notify the class.*

If a student fails to comply with the COVID-19 Expectations for Students or other University expectations related to COVID-19, the instructor may ask the student to leave the class. The

instructor is asked to report the incident to the Office of Community Standards for additional follow-up.

Class Modality Exceptions

Class sessions for this course will occur in person. Individual students will not be granted permission to attend remotely except as the result of an Americans with Disabilities Act (ADA) accommodation as determined by AccessibleNU.

Class Recordings

This class or portions of this class will be recorded by the instructor for educational purposes. Your instructor will communicate how members of the class can access the recordings. Portions of the course that contain images, questions or commentary/discussion by students will be edited out of any recordings that are saved beyond the current term.

Prohibition of Recording of Class Sessions by Students

Students are prohibited from recording class sessions and are also prohibited from the distribution of class recordings.

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University’s Copyright Policy, faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

Support for Wellness and Mental Health

Northwestern University is committed to supporting the wellness of our students. Student Affairs has multiple resources to support student wellness and mental health. If you are feeling distressed or overwhelmed, please reach out for help. Students can access confidential resources through the Counseling and Psychological Services (CAPS), Religious and Spiritual Life (RSL) and the Center for Awareness, Response and Education (CARE). Additional information on all of the resources mentioned above can be found here:

<https://www.northwestern.edu/counseling/>

<https://www.northwestern.edu/religious-life/>

<https://www.northwestern.edu/care/>