

# ME 314: Theory of Machine Dynamics Syllabus

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**Location:** TBD

**Time:** MTWF 12:00-12:50 PM

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

**Instructor Office Hours:** TBD

**TA:** TBD

**TA Office Hours:** TBD

**Exam:** There will one in-class exam roughly two thirds of the way through the class

**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-  
ratory (<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:	40% of total grade.
Exam:	40% of total grade
Final Project:	20% of total grade.

However, students who turn in two *handwritten* copies of their class notes, both of which must be easily read by me, will at minimum get a C- in the course so long as they have attempted all the homework (including all questions) and the project. (This provides a means for students to do acceptably in the course even if they are struggling.) Students must start turning these in online by October 11, 2019 and must turn them in weekly thereafter if they wish to use the policy.

Note that I anticipate 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 be 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/>.