

Physics 3318: Analytical Mechanics
Spring 2023
Cornell University Department of Physics

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Time Zone Convention: All times quoted throughout the course are US Eastern (Ithaca).

Instructors

Primary Instructor: Jared Maxson, jmm586@cornell.edu
Office Hours: TBD and by appointment.

Teaching Assistant: Naomi Gendler, ng434@cornell.edu
Office Hours: by appointment.

Grader: Alec Duquette, ad683@cornell.edu

Lecture: MWF, 10:10-11:00 am RCK 122

Discussion Sections: RCK 105

DIS 201	DIS 202
Tues 2:40-3:30 pm	Mon 3:35-4:35 pm

Note: You must attend the discussion section for which you are registered. Please check Student Center to verify.

PDFs of both section and lecture notes will be posted to Canvas.

Attendance in lecture and section is required.

Homework Parties/Group Office Hours: Thursdays, 4-6 pm, Clark 294E

Textbook: No official textbook required. We will draw from three great texts throughout:

- Landau and Lifshitz, Mechanics, Volume 1
- Goldstein, Poole & Safko, Classical Mechanics (preferably 3rd Edition)
- Hand and Finch, Analytical Mechanics

Each one contains nearly all the physics covered in the course. All are available in the Cornell Library (and L+L is even available as an ebook!): <https://www.library.cornell.edu>.

Please contact Prof. Maxson if you need help with textbook access.

Grading Breakdown: Homework (30%, ~1 set/week), two prelims (18% each), final exam (30%), participation (4%)

Prelim Schedule: See course schedule on syllabus canvas page

Final Exam time: TBD

Homework: Homework submission is handled through Gradescope. The lowest two HWs will be dropped, because things happen! Homework is graded on both accuracy and presentation. All homeworks count equally. HWs are due at **5 pm** via gradescope the day listed in the course calendar. No late submissions will be accepted by gradescope.

Academic Integrity: Each student in this course is expected to abide by the Cornell University [Code of Academic Integrity](#). Any work submitted by a student in this course for academic credit will be the student's own work.

Announcements will be typically posted to our Canvas site.

Where to go for help, questions or concerns: In general, all of the course staff, *including Prof. Maxson, are more than happy to meet with you to discuss questions or concerns.* We want you to succeed! Please don't be afraid to ask to set up a zoom appointment.

Common questions and concerns, and who to contact are listed below:

If you'd like to discuss grading on a particular HW or Exam problem, please either submit a regrade request through gradescope or message the grader. The grader will then contact Prof M if more help is needed.

Do you think there is an error or typo in the lecture notes or in the HW? For homework, please contact your TA, and for Lecture, please contact Prof M. We appreciate your help identifying these and like to correct them ASAP!

If you are struggling with the course content and/or would like advice on how to optimize your approach, please let your TA and Prof M know. Your TA will specialize in helping you with the subject matter, and Prof M is happy to work with you both on subject matter and on general study and exam prep strategies.

Please reach out to Prof M directly for the following:

If you are concerned about your grade and would like to discuss your standing in the course. Note: We have a course-wide discussion of estimated grade boundaries after each prelim.

If a life event or COVID-19 complications will significantly change your ability to participate for an extended period of time.

If you require special accommodations for any aspect of the course.

A final note from Prof M:

Cornell University (as an institution) and I (as a human being and instructor of this course) are committed to full inclusion in education for all persons. Services and reasonable accommodations are available to students with temporary and permanent disabilities, to students with DACA or undocumented status, to students facing mental health issues, other personal situations, and to students with other kinds of learning needs. Again, please feel free to let me know if there are circumstances affecting your ability to participate in class. Some resources that might be of use include:

- Office of Student Disability Services, <https://sds.cornell.edu/>
- Cornell Health CAPS (Counseling & Psychological Services), <https://health.cornell.edu/services/counseling-psychiatry>
- Undocumented/DACA Student Support, Kevin Graham (Kevin.Graham@Cornell.edu), list of campus resources can be found here: <https://dos.cornell.edu/undocumented-daca-support/undergraduate-admissions-financial-aid>
- Learning Strategies Center, <http://lsc.cornell.edu/>

I would be glad to help you identify other resources if needed.

Week of	Mon	Tue	Wed	Fri
	1/23 L1: Coords + Constraints		L2: Hamilton's Principle + E-L eqns	L3: Discovering L
S0: Math for 3318	S0: Math for 3318			
	1/30 L4: Using the Lagrangian		L5: Example Problems	L6: Discovering Conservation Laws I
S1: Variational Calc	S1: Variational Calc		HW 1 Due	
	2/6 L7: Discovering Conservation Laws II		L8: Lagrange Multipliers	L9: 1D Systems
S2: Equilibria	S2: Equilibria		HW 2 Due	
	2/13 L10: Nonlinear Pendulum		L11: The Two-body Problem	L12: The Kepler Problem
S3: Lagrange Mult	S3: Lagrange Mult		HW 3 Due	
	2/20 L13: Gravitational Orbits		L14: Scattering I	L15: Scattering II
S4: Review	S4: Review		HW 4 Due	
	2/27 No Class	No Class	L17: Buliding a Green's Function (SHO)	L18: Coupled Oscillators I
HW 5 Due				
	3/6 L19: Coupled Oscillators II		Prelim 1 in class (up to Lec 15)	L20: Rotational DoFs
S5: Gravitational "Scattering"	S5: Grav. "Scattering"			
	3/13 L21: Moment of Intertia Tensor		L22: Precession	L23: Euler Angles
S6: Tensors	S6: Tensors		HW 6 Due	
	3/20 L24: The Heavy Spinning Top Problem		L25: Non-Inertial Frames	L26: Intro to Hamiltonian Dynamics
S7: Rotational DoF Examples	S7: Rot DoF Examples		HW 7 Due	
	3/27 L27: Poisson Brackets + Phase Space		L28: Liouville's Theorem	L29: Canonical Transformations
S8: Legendre Transform	S8: Legendre Transform		HW 8 Due	
	4/3 No Class	No Class	No Class	No Class
	4/10 L30: Generating Functions		L31 The Hamilton-Jacobi Eqn.	L32: Solving the HJE
S9: Review	S9: Review		HW 9 Due	
	4/17 L33: Action Angle Coordinates		Prelim 2 In CLASS (Up to Lec 29)	L34: Perturbation Theory I
S10: Canon.Transform Example	S10: Canon.Transf.Ex.			
	4/24 L35: Perturbation theory II		L36: Nonlinear Oscillators	L37: Chaos I
S11: Perturbation Thry	S11: Perturbation Thry		HW 10 Due	
	5/1 L38: Chaos II		L39: Chaos III	L40: Review
S12: Chaos and Review	S12: Chaos and Review		HW 11 Due	
	5/8 L41: Review	Last Day of Classes		
No Section	No section			