Applied Physics 3330: Mechanics of Particles and Solid Bodies

Prerequisites: Physics 112 or 116 and AEP3200.

Instructor: Dr. Lisa Wickham, 233 Clark, lw45@cornell.edu Office hours will be announced. This week's hrs: Wed Aug23: in 233 Clark 11:15-11:45 & on Zoom 8:15-8:45pm & by appointment.

Homework: I plan for problem sets to be due (roughly weekly) on Thursdays, unless otherwise specified. My plan is for submission through Canvas assignments, and to get full credit the homework should finish the upload process by the Canvas "deadline" time. The official deadline is a few minutes before the Canvas one (at 1:10pm this week) to allow for slow uploads.

You are welcome to discuss the homework with each other, but you must turn in your own *clearly distinct*writeup!!!! Explain your reasoning in YOUR OWN words when writing answers to the problems, whose final version should come from your own unique problem solving effort. The total homework score will be worth about 22% of the course grade. Late homework papers (that have no prior extension from me) will have their score multiplied by .85 (15% off) unless turned in after the availability cutoff of the Canvas upload link, after which they will receive no credit.

TA: Wayne Wang xw688@cornell.edu.

Office hrs tbd but likely this week Thurs. 11:35 – 12:30 hopefully in Clark 218 (see Canvas)

Required text: J.R. Taylor, *Classical Mechanics*, University Science Books, 2005.

Optional reference I've requested to be on reserve (in addition to Taylor):

1. T. Thornton and J. B. Marion, *Classical Dynamics of Particles and Systems*, 5th edition,

Brooks/Cole 2004.

Lecture: MWF 10:10-11:00am Clark 247. Please quiet your phone – thanks.

Recitation: Tuesday 1:25pm-2:40pm, Clark 247. Important! Email if you have a potential conflict!

Exams: I'm currently planning prelims on the evenings of Oct. 5 and Nov. 9, so please let me know ASAP if you have a conflict. I don't know what date will be assigned for the final (about 31% of course grade). I estimate that prelims will be about 38% of the total grade (19% each). Exams will include problems with shorter and somewhat longer answers, to test both knowledge of concepts and problem solving.

Participation: About 9% of the final grade will be reserved for completing & uploading "participation credit" activities, listening to and participating in lectures and recitation

Unstructured Zoom time? If there's interest, I can set a zoom link for student interaction.

Course website: Please check announcements on the Canvas AEP3330 website regularly.

Integrity: This course will maintain academic integrity – see http://cuinfo.cornell.edu/aic.cfm .

The graduate level version of the course, numbered 5330, would be treated as a distinct population and would have the additional requirement of a couple of in-person verbal quizzes if anyone signs up for this version of the course.

Selected Topics

(I may have to trim this if time is tight)

- Curvilinear coordinates and other ways to approach velocity
- Review of Newtonian mechanics, including dissipative forces (friction & drag)
- Center of mass and moment of inertia *I* (with respect to origin at either center of mass or pivot), with application to angular momentum, torque, and kinetic energy.
- Linear oscillators with damping and driving forces, or coupled oscillators
- Brief introduction to nonlinear systems (the real world) – surprises include chaos!
- The calculus of variations (e.g. what y(x) minimizes , given fixed endpoints?)
- Lagrangians and Hamiltonians (useful for quantum, statistical mechanics, robots, …)
- Motion in a central force (e.g. Earth around Sun, which helps some with electron around proton)

- Brief intro to scattering (with terms like “cross section” & “solid angle”)

- Accelerated reference frames

(if you stick coordinate axes to Earth you get small but key corrections)

- Full 3D treatment of rigid body motion (e.g. spinning tops). *I* will become a tensor because angular momentum is not always parallel to angular velocity .