PHYSICS 311, Advanced Dynamics, Spring 2019

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Lectures: Tuesdays and Thursdays, 1:15 - 2:30 pm, Waterman 456

Office hours: Tuesdays 2:30 - 4:30 pm, or by appointment

Textbook: *"Classical Mechanics,"*
3-rd Edition, by H. Goldstein, C. Poole, and J. Safko
Addison-Wesley, 2001. (ISBN-13: 978-0201657029)

Reading material and homework assignments will be given from the above graduate-level textbook. Thus you have to have access to it. It is available, for example, on amazon.com (where one can also "rent" it for a very reasonable price), and can be found in many other places as well. The newest (3-rd) edition is an enlarged and updated version of the classic graduate text by Goldstein. (I can provide the first several chapters on the blackboard page of the course until you get the text.)

Other books:

"Mechanics," 3-rd edition, L.D. Landau and E.M. Lifshitz, Pergamon Press, 1976 (and reprinted many times since). This is a classic text as part of the famous Landau-Lifshitz theoretical physics course (Volume 1). I am very fond of it. It is very short (< 200 pages) but covers, with incredible clarity, all important topics. However it is written for advanced/experienced students of physics, in a very tight style (unlike the Goldstein book.) Each chapter contains problems (with solutions.) Every physicist should take a look at it; I personally use it frequently.

Prerequisites: Knowledge of Classical Mechanics at intermediate (undergraduate) level. At UVM this means one semester of Physics 211. In the past several years we have been using the book "Classical Mechanics" by J.R. Taylor for Phys 211 (covering Chapters 1-11), but any other book/course at that level is also OK. If you have doubts/questions about your background please come and discuss it with me. Generally speaking I think you can fill in any gaps as we go along.

General Course Description: This is a graduate course devoted to advanced topics in classical mechanics. We will cover:

- Variational calculus. Generalized coordinates and constraints.
- Hamilton's principle and the Lagrange equations of motion.
- Conservation theorems and symmetries.
- Central forces; general relativity corrections to Kepler orbits
- Hamiltonian formulation and the Principle of Least Action.
- Canonical transformations and Poisson brackets.
- Hamilton-Jacobi method; action-angle variables.
- Adiabatic invariance; Liouville's theorem.
- Kinematics of rigid body motion – tensor notation.
- Rotation matrices, rotating frames. Rigid body dynamics
- Linear oscillations - normal modes, symmetry groups.
- Nonlinear oscillations.
- Lagrangian and Hamiltonian formulations for continuum systems.

Homework/Exams/Grades: Homework will be assigned on a regular basis, probably every other week or so. There will be one midterm and a final exam, possibly/probably take-home. Grades will be based on the homework (roughly 50%), and the exams (50%).