Physics 330: Analytical Mechanics
Fall (3) 2016
Course Information

Instructor: Mark Taylor **Office:** Gerstacker 118 **Phone:** (330) 569-5241 (office)
Email: taylormp (330) 342-1145 (home)

Office Hours: MTRF 11:00-12:30, 3:00-6:00, Wed. 9:00-6:00, Sun. noon-6:00.
Also, feel free to stop by at other times, call me, or send me email.

Meeting Times: MTRF 9:30-11:00, 1:30-3:00, Colton 2

Textbook: There is no official textbook ... I will supply reading materials.
A math handbook that includes integral tables (e.g. Schaum's or CRC) is recommended.

Other References: Thornton and Marion, "Classical Dynamics"; Taylor, "Classical Mechanics".

Course WebPage: http://www.hiram.edu/majors-and-minors/physics/courses/analytical-mechanics

Course Overview and Goals: This course will provide an intensive study of classical mechanics. This elegant subject provides the foundation to all fields of physics and thus a solid grasp of this material is essential. We begin with a review Newtonian mechanics as learned in Physics 213, however, we will be working at a much higher level of mathematical sophistication than was possible in 213. We will then study two important reformulations of Newtonian mechanics based on the calculus of variations. These are the Lagrangian and Hamiltonian approaches. These new methods yield the same results as the original Newtonian method, but for complicated systems they are often much easier to apply. Finally we will use these new methods to make a detailed study of central force motion (i.e., the two body problem) and rigid body rotational dynamics. The primary goal of this course is to learn some of the advanced techniques of analytic mechanics. A more general goal is to learn to do physics at a more formal level. Historically, this formal approach has been extremely productive in physics, leading to connections between disparate fields of study. Such formal methods provide a systematic approach to tackling complex problems. A final goal for this course will be to learn some important approximation and numerical techniques, since for most "real world" problems, exact analytic calculation will only take us so far.

Class Format, Preparation, and Participation: This three-week version of mechanics meets both morning and afternoon four days per week. Our morning sessions will be devoted to lecture and discussion of new material. The afternoon sessions will be devoted to problem solving. It is very important that you complete the assigned reading *before each morning session*. Having some time to think about the material beforehand will make these class meetings a lot more useful, so please come to class with questions and prepared for discussion. In the afternoon session you will all be presenting problems on the board. The break between sessions should allow enough time for you to prepare your solutions. These presentations will be your chance to teach us. I expect these presentations to be interactive, so you should be asking questions of your audience (and I fully expect your audience to be asking questions of you). From my own experience I know that one of the best ways to learn something is to try to teach it to someone else.

Homework: As you well know by now, learning physics has a lot to do with "doing" physics and thus the problem sets are a very important part of this course. I encourage you to talk with each other about, and work together on, these problem assignments (*but direct copying of someone else's solutions is forbidden*) and please come see me if you have questions. Your written solutions are due on Sundays by 3 pm and Wednesdays by 5 pm (see syllabus for exceptions). Solution sets and (hopefully) graded papers will be returned within a day.

Exams: There will be a take-home midterm and a take-home final exam.

Grading:

Class participation and presentations	15%
Problems sets	50%
Exams (high grade=20%, low=15%)	35%

Final grades are based on a fixed scale: ≥88%=A, ≥76%=B, ≥64%=C, ≥52%=D.
(For each letter grade, a "+" or "–" corresponds to the upper and lower 4% of the range.)