Physics 300: Mechanics

Time: MTWRF 12:30-1:20
Professor: Dr. Brianna Dillon Thomas
Email: bthomas2@gustavus.edu
Location: OHS 216
Office: OHS 212, x7311
Office Hours: TWRF 1:30-2:30 and by appointment

Prerequisites: PHY-215 (Electomagnetic Universe) and PHY-250 (Applied Mathematics for Scientists & Engineering).

Course Description:
From the catalog: An extension of classical mechanics introduced in PHY-195 and PHY-205 to those formal developments of mechanics appropriate to the study of the quantum theory. Topics include Lagrangian and Hamiltonian dynamics, vibrating systems, and mechanics of rigid bodies.

From me: This course is a transition into advanced physics classes. Many of the concepts will be familiar, but now that you are equipped with advanced mathematics from your Applied Mathematics course (eg vector calculus, linear algebra, differential equations), you will be able to tackle a much wider and more sophisticated variety of problems. In addition to providing you with a deeper understanding of analytical mechanics itself, this course will familiarize you with the mathematical rigor required of advanced physics topics, and, through our study of Lagrangian and Hamiltonian dynamics, will introduce you to techniques that are vital to the study of modern physics topics such as quantum mechanics.

Course Materials:

Required Textbook: *Classical Dynamics of Particles and Systems,* 5th edition, Thornton & Marion
Recommended: *Mathematical Handbook of Formulas and Tables*, by Murray R. Spiegel (Schaum's Outline Series)
Moodle page: Physics 300, Fall 2016-17

Course Objectives and Expectations:

Intended Learning Objectives: By the end of the semester you should be able to do the following:

1. Understand the formalism that undergirds the study of analytical mechanics
2. Apply good problem solving methods to physics problems
3. Apply mathematical techniques introduced in previous classes to analyze physics problems
4. Use the Newtonian method to analyze physical situations and problems
5. Use the Lagrangian method to analyze physical situations and problems
6. Use the Hamiltonian method to analyze physical situations and problems.

What I expect from you:

- Actively engage in class
- Complete assignments on time
- Respect and support your classmates' learning in and out of class
- Advance notice of anticipated schedule conflicts
- Check email and Moodle regularly for course updates

What you can expect from me:

- Enthusiasm for physics
- An atmosphere of respect where questions are welcome
- Clear communication of expectations on assignments and exams
- Available during office hours with an open door policy
- Check and respond to email regularly during normal class meeting hours

Course Components:

Grading summary:	
Reading Quizzes (drop lowest)	10%
Homework sets	20%
Exams (3 midterms, 15% each)	45%
Final Exam	25%

Grading Scale*:	
A	90-100%
B	80-90%
C	70-80%
D	55-70%
F	55%

**Grade lines may shift at my discretion, but only in the direction of lowering the grade boundaries*

In-class: Class time will utilize a combination of lecture and group work. Come prepared to be engaged!

Reading/Reading Quizzes: Most days have a section of the textbook associated with the class. I expect you to read those sections *before* you come to class, and assume you are able to learn some basic material on your own. Reading quizzes will be announced in class and administered on Moodle 1-3 times a week. Outside of the quiz content, I do not expect you to understand everything you read; however, class time will be much more helpful if you come in having a general idea of what we're going to cover, the rough outline of a derivation, or what points seem the most confusing to you.

Homework assignments: One of the best ways to learn physics is through working problems. You cannot truly learn physics without independently tackling the ideas discussed in class and practicing organizing your thinking. On the other hand, sometimes you may get stuck, in which case you are encouraged to work with your classmates or consult other resources (see **"Collaboration policy"**), as long as ***all work you turn in is your own.***

Homework will be assigned on a per-chapter basis on the day we start a new chapter and will be **due at the start of class** 1-2 class periods after we finish a chapter. I will announce a tentative deadline when assigning the problems; this deadline may be moved later but will rarely be moved earlier. *It is in your best interest to look at the assigned problems after each class period* to see what you are able to do with your new knowledge.

Homework Guidelines:

- **Format:**
  - All homework should be on one side of the page only with your name at the top of the pages; should be neat, not cramped, and legible; and should have multiple pages stapled together.
  - Briefly summarize the essentials questions of the problem, so you know what the problem is about without having to reference the textbook.
  - Include any relevant diagrams or set-up equations.
  - For conceptual/graphing problems, include a clear, sufficiently detailed explanation of how you got to your answer.
  - For quantitative problems: a) Solve the problem analytically to the simplest possible form. b) If asked, calculate the final numerical solution. c) Underline or box your final answer. d) Check the answer for reasonableness: eg dimensional correctness, limiting cases, etc.
  - *Allowed mathematical resources:* You are allowed to use some non-textbook resources to aid in solving more complicated steps in a problem. a) Mathematics handbooks, eg to look up trig identities or an integral solution*. You should reference the book and equation number used in your solution.* b) Mathematica. You may use Mathematica in the same way you would a math handbook - to help find the general solution to a step in the problem - but *must include a print-out of what you did* (this may be a separate page that you reference by line number, or a smaller print-out taped to the homework page at the relevant step). You should NOT enter non-zero numerical values specific to the problem for bounds, limits, or variables EXCEPT when there is no clearly defined solution otherwise (as is the case with some special definite integrals). When in doubt, ask for clarification. You may NOT solve the problem in its entirety using Mathematica, or use Mathematica to generate graphs, unless explicitly specified.

- ***Late Homework policy:*** Written sets turned in after the deadline will be deducted 5% for every 24-hr period after the deadline, including over weekends, until I start grading the problems. I will not accept any assignments after I start grading. If you have an anticipated reason that might warrant an extension, come talk to me as soon as you are aware of it. Last-minute or after-the-fact exceptions will only be granted under extenuating circumstances; if you miss a homework due to a last-minute but excusable reason, let me know as soon possible.
- ***Collaboration policy:*** Collaboration on homework is allowed, and is encouraged if you find yourself stuck on a problem. *However, all assignments must be your own work*. The best approach is to first attempt the homework on your own, then talk and work with a classmate or other resource if you get stuck, then write out the final problem solution independently in your own words. You should also ask yourself if you would be able to solve a similar problem on your own without help – as you will have to on the exam. ***The following constitute a violation of academic honesty:*** Copying solutions from a classmate, an upperclassman, or the web; "co-writing" a non-group assignment; failing to reference non-textbook sources; or using forbidden resources. Violating these will result in grade penalties.

Exams: There will be three hour exams and a comprehensive final exam. The hour exams will be given after Chapters 2, 5, and 8 with sufficient time for homework to be returned for studying; dates will be announced in class at least a week in advance. The final exam will be on **Friday, December 15, 3:30-5:30pm**. If you have a valid school or health related conflict with attending the exam at the scheduled exam time, you must request an alternative arrangement ***no later than 1 week in advance of the exam***, ideally, you should notify me as soon as you are aware of the conflict.

Other Course Policies:

Regrades: Requests for a regrade of homework or exams must be ***submitted in writing within a week of your receiving the graded assignment***. You should submit the original, unaltered assignment with a cover sheet describing your request stapled to the front.

Technology use: Use of cell phones, smartphones, laptops, tablets, and other electronics is prohibited in class except by permission of the professor.

Academic Honesty policy: You are expected to live up to the expectations of the College's academic honesty policy (see below, and at https://gustavus.edu/general_catalog/current/acainfo). By writing your name on any graded assignment, or by clicking "submit" on an online assignment, you are attesting that the assignment has been completed to the standards of the honor pledge:

> **Honor pledge: "**On my honor, I pledge that I have not given, received, or tolerated others' use of unauthorized aid in completing this work."

Accessibility resources: Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability, or you think you may have a disability of any nature (e.g., mental health, attentional, learning, chronic health, sensory, or physical) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Accessibility Resources staff, for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Accessibility Resources as early as possible. Accessibility Resources (https://gustavus.edu/advising/disability/) is located in the Center for Academic Resources and Enhancement. Accessibility Resources Coordinator, Kelly Karstad, (kkarstad@gustavus.edu or x7138), can provide further information.

Weekly Schedule: See Moodle for a detailed schedule that will be updated weekly. *There will be no classes during the Nobel Conference.*