

# Syllabus for Algebra-Based Physics-1: Mechanics (PHYS135A-01)

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## Abstract

The concepts of algebra-based mechanics will be presented within the context of interactive problem-solving. First, the concepts of displacement, velocity, and acceleration in one and two dimensions will be introduced, building up to Newton's Laws of motion. Next, the concepts of friction and rotational motion will be added. More complex problems will be introduced through the conservation of energy and linear momentum, followed by the rotational equivalents. The course work will include interactive computational exercises, analytic textbook problems, and lab-based activities.

**Regular course hours:** Monday and Wednesday from 8:50 - 10:50 in SLC 228

**Office hours:** Tuesdays at 12:50 and Wednesdays at 15:00 in SLC 212

**Text:** College Physics (openstax.org) - <https://openstax.org/details/books/college-physics>

**Grading:** There will be four 45-minute midterms, each examining conceptual understanding in step-by-step problems. Each midterm is worth 12.5% of the final grade. The ExpertTA system (\$30.00 online) will manage the homework sets, which are due weekly and worth 20% of the grade. Interactive in-class activities will be worth 15% of the final grade. The final exam will be held on December 13th for a half-class period, and will be worth 15% of the grade.

1. Week 1 - September 6th through September 8th - **Chapter 1**
  - (a) Estimations, approximations, unit-analysis, and coordinate systems
  - (b) Adding and subtracting vectors, displacement and translational motion
  - (c) *Mathematics review: geometry, trigonometry*
2. Week 2 - September 11th through September 15th - **Chapters 2.1-2.6**
  - (a) Velocity and acceleration
  - (b) Acceleration due to gravity near the Earth's surface and other constant accelerations
  - (c) Common equations of motion for constant acceleration
3. Week 3 - September 18th through September 22nd - **Chapters 2.7-2.8, Chapters 3.1,3.4-3.5**
  - (a) Kinematics with vectors
  - (b) Projectile motion
  - (c) Addition of velocities, relative motion
4. First midterm exam, beginning of week 4
  - (a) Estimations, approximations, and unit-analysis
  - (b) Displacement, velocity, and constant acceleration
  - (c) Vectors
5. Week 4 - September 25th through September 29th - **Chapters 4.1-4.3**
  - (a) Newton's Laws
  - (b) Examples and free-body diagrams
6. Week 5 - October 2nd through October 6th - **Chapters 4.4-4.7**
  - (a) Newton's Laws, continued
  - (b) Examples of frictional forces, drag, tension

7. Second midterm exam, beginning of week 6
  - (a) Newton's laws and free-body diagrams
  - (b) Friction, drag, and tension
8. Week 6 - October 9th through October 13th - **Chapter 6.1-6.3, 6.5-6.6**
  - (a) Angular displacement, angular velocity and centripetal acceleration
  - (b) Newton's law of gravity, circular orbits
  - (c) Kepler's laws
9. Week 7 - October 16th through October 19th - **Chapters 7.1-7.4**
  - (a) Work, kinetic and potential energy
  - (b) Work-Energy theorem
  - (c) Conservative forces and potential energy
10. Mid-semester break, October 20th
11. Week 8 - October 23rd through October 27th - **Chapters 7.6-7.8**
  - (a) Conservation of energy
  - (b) Power
  - (c) *Work, energy and power in human beings*
12. Third midterm exam, beginning of week 9
  - (a) Gravitation and Kepler's Laws
  - (b) Work-Energy theorem
  - (c) Conservation of energy
13. Week 9 - October 30th through November 3rd - **Chapters 8.1, 8.3-8.5**
  - (a) Linear momentum
  - (b) Conservation of momentum and Newton's second law
  - (c) Elastic scattering
  - (d) Inelastic scattering
14. Week 10 - November 6th through November 10th - **Chapters 8.6-8.7**
  - (a) Momentum conservation, continued
  - (b) Two-dimensional scattering
  - (c) Rockets
15. Week 11 - November 13th through November 17th - **Chapters 10.1-10.4**
  - (a) Rotational displacement, velocity, and acceleration, continued
  - (b) Moments of inertia and angular momentum
  - (c) Kinetic energy of angular motion
16. Forth midterm exam, beginning of week 12
  - (a) Conservation of momentum
  - (b) Scattering in one and two-dimensions
  - (c) Rotational motion
17. Week 12 - November 20th and November 21st - **Chapters 10.5**
  - (a) Conservation of angular momentum
18. Week 13 - November 27th through December 1st - **Chapter 9**
  - (a) Torque and Newton's second law, angular case
  - (b) Statics and torque
19. Week 14 - December 4th through December 8th - **Programming demonstrations and final review**