

Advanced Mechanics. Fall 2014

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Text: This book is required.

- **John R. Taylor, Classical Mechanics, University Science Books, ISBN-10: 189138922X | ISBN-13: 978-1891389221, Publication Date: 2005.**

This book is recommended.

- L.D. Landau and E.M. Lifshitz, Mechanics, 3rd edition

Grading:

2 exams	50%
Final (comprehensive)	30%
Homework (weekly)	20%

Evening exams on **October 3, November 7; 7:00-9:00pm; MPHY 213**

Final exam: **December 16, Tuesday 8-10 a.m.**

Prerequisites and Co-requisites: freshman mechanics, e.g. PHYS 218 or equivalent, calculus, and differential equations

Syllabus:

Block 1: Review of Newton's laws

Vectors, scalar product, vector product. Einstein notations. Kronecker delta. Levi-Civita symbol.

Frames of reference. Principle of relativity. Newton's first law.

Concepts of mass and force. Newton's second law. Newton's third law.

Oscillations. Oscillations with friction and external force. Resonance.

Conservation of momentum. Rocket motion.

Air resistance, charged particles in electric and magnetic fields

Kinematics in cylindrical coordinates. Angular momentum

Work-energy theorem. Energy conservation

Potential energy

One-dimensional motion

Central forces. Effective potential

Kepler orbits.

Virial theorem

Block 2: Lagrangian mechanics

Calculus of variations

Hamilton's principle

Lagrange's equations

Generalized coordinates
Ignorable coordinates and conservation laws
Constrained systems

Block 3: Hamiltonian mechanics. Taylor Ch. 13, Landau Ch. 7.

Hamilton's equations
Phase space
Canonical transformations
Poisson brackets

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