

Advanced Mechanics. Fall 2018

Instructor: Artem G. Abanov

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Office Hours: MWF 10:10-11:00

Text: Required book:

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

Recommended book:

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

Grading:

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| 1 exam | 30% |
| Final (comprehensive) | 30% |
| Homework (weekly) | 40% |

Exam: **October 15; MPHY 213**

Final exam: **December 10, Monday, 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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