Advanced Mechanics. Fall 2019

Instructor: Artem G. Abanov
Web page: http://faculty.physics.tamu.edu/abanov/
email : abanov@tamu.edu
Office: MPHY 415
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:

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

Exam: **October 16; MPHY 213**
Final exam: **December 9, 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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