Syllabus: Phys 530, Theoretical Mechanics

Text

Classical Dynamics: A Contemporary Approach by J.V. Jose and E.J. Saletan

Optional Text

Classical Mechanics by H. Goldstein

Approach

The course is designed to show case the power of the Lagrangian and Hamiltonian formulism of mechanics for solving complex problems in mechanics, as well as some neat results in nonlinear dynamics, rigid bodies, and fluid mechanics. The principles and techniques taught in the course will be important for understanding issues and solving problems in other braches of physics, such as electrodynamics. These techniques will also be useful for research in contemporary physics and other sciences.

Outline

1. Lagrange's equations, the variational principle, constraints, symmetry and conservation equations
2. Linear oscillators
3. Tangent bundle
4. Hamilton's canonical equations, Poisson brackets, canonical transformations, Liouville Theorem and Darboux Theorem
5. Hamilton-Jacobi method, action-angle variables, perturbation theory, adiabatic invariance
6. Chaotic scattering, nonlinear oscillators, stability analysis, parametric oscillators, discrete maps and chaos, KAM theorem

Grading Policy

Homework 60%, final 40%