Topics Covered in PHYSICS 6309
Advanced Mechanics

Course Outline

(1) **Newton's laws and application**s
   - Configuration and phase space
   - Conservative force fields; central fields
   - Angular momentum and conservation
   - Investigations of motion in a central field; bounded and unbounded orbits
   - Kepler's problem
   - Motion of a system of N point masses

(2) Variational Principle
   - Calculus of variations
   - Lagrange's equations
   - Legendre transforms
   - Hamilton's equations
   - Liouville's theorem
   - Phase flow and preservation of phase volume
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(3) Lagrangian Mechanics on Manifolds
   - Lagrangian dynamical systems
   - Noether's theorem
   - D'Alembert's principle
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(4) Oscillations
   - Linearization and small oscillations
   - Parametric resonance
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(5) Rigid Bodies
   - Motion in a moving coordinate system
   - Inertial forces and Coriolis forces
   - Rigid bodies
   - Euler's equations

(6) Differential Forms
   - Forms
   - Exterior multiplication
   - Differential forms
   - Integration of differential forms
   - Exterior differentiation; Stokes' formula

(7) Canonical Formalism
- Integral invariant of Poincare-Cartan
- Application
- Huygen's principle
- Generating functions

(8) Perturbation Theory
- Integrable systems
- Action-Angle variables
- Averaging perturbations

Suggested Books:
(1) Mathematical Methods of Classical Mechanics; V. I. Arnold
(2) Classical Mechanics; H. Goldstein, C. Poole, and J. Safko
(3) Mechnics; L. D. Landau and E. M. Lifshitz.