

# PHYS 401 SYLLABUS

1. Position, Velocity, Acceleration (example: [MIT-OCW video](#))
2. Newton's Laws (example: [MIT-OCW video](#))
3. Notion of Material Point and Generalized Coordinates (example: [MIT-OCW video](#))
4. Kinetic-Potential in Coordinate Space (Lagrangian), Action functional (example: [Feynman Lectures](#))
5. Principle of Stationary Action and Equations of Motion in Coordinate Space (examples: [this video](#) and [Feynman Lectures](#) and this [Khan video](#) on variational calculus)
6. Conservation Laws (Energy, Momentum, Angular Momentum) (example: [MIT-OCW video](#))
7. Conserved Quantities: Energy and Angular Momentum (example: Kepler problem in this [NTNU video](#))
8. Conserved Quantities: Momentum (and Impulse) (example: [PBS video](#))
9. Minimum Energy Configuration and Small Oscillations (example: [NTNU video](#))
10. Macroscopic (rigid) Body Motion (example: [this video](#) and [that video](#))
11. Phase Space, Kinetic + Potential (Hamiltonian), Action functional, and Equations of Motion in Phase Space (example: [this video](#))
12. Canonical Transformations, Poisson Brackets, Liouville's Theorem (example: [this video](#))
13. Wave Characteristics Beneath Newton's Equations (Hamilton-Jacobi Equation) (example: [this video](#))
14. The Galilean Relativity, and Introduction to Special Relativity (example: [this video](#))