

Physics 410
Physical Mechanics I

Fall 2005

M-T

Chap. 1 } 0) Mathematical Review: see notes & Read Chap 1

Chap. 2 } (I) Newton's laws: 1) Galilean Invariance 2) $\vec{F} = \dot{\vec{p}}$ 3) $\frac{m_1}{m_2} = \frac{|\vec{a}_2|}{|\vec{a}_1|}$
A) Examples — Read Chap. 2
B) Conservation Laws: \vec{P}, \vec{L}, E
1) Single Particle
2) System of Particles

Chap. 9

Chap. 7 } (II) Lagrangian Dynamics
A) Euler-Lagrange Equations & Cartesian Coord.
B) Generalized Coordinates
C) Euler-Lagrange Eq. of Motion (\equiv Newton's 2nd Law)

Chap. 3

Chap. 12

Chap. 13

- 1) Harmonic Oscillator + Damping
- 2) Coupled Oscillators & Normal Coordinates
- 3) Chain of oscillators — String
- 4) Continuum Mechanics — Membrane, fluid
- 5) Wave Equations
- 6) Electromagnetic Field

Chap. 7

- D) Constrained Dynamics — Lagrange Multipliers
 - 1) Examples
- E) Conservation Theorems Revisited
- F) Virial Theorem

Chap

8

(III) Newtonian Gravity & Central Potentials
A) Reduced Mass
B) Equations of Motion & Symmetry

- Chap. 8 } (III) ... C) Effective Potential
... D) Orbits
... E) Newtonian Cosmology

- Chap. 9 } (IV) ... Scattering Theory
... A) Cross Sections
... B) Rutherford Scattering

- Chap. 6 } (V) ... Calculus of Variations
... A) Mathematics of variational calculus
... B) Hamilton's Principle

- (VI) ... Special Relativity
... A) Newton's Laws Revisited - Lorentz Transformation
... B) Tensors
... C) Lorentz Force
... D) Lagrangian & Hamilton's Principle
... E) Conservation Laws: Energy-Momentum Tensor
... F) Examples of Trajectories

- (VII) ... Gravitation & General Relativity
... A) GR & Newton's Laws
... B) Riemannian Tensors
... C) Lagrangian & Einstein's Equations
... D) Examples
... 1) Robinson-Walker metric
... 2) Newton's Law for Gravity
... 3) Black Hole
... 4) Perihelion Shift
... 5) Friedmann Eq. & Cosmology