Advanced Physics Syllabus

Readings from Understanding Basic Mechanics, Frederick Reif

I.	Intro A. B.	ductory Mechanics and Problem Solving ReviewGeneral Problem SolvingAP B Mechanics Problems and Group Work1.Kinematics2.Statics and Dynamics3.Energy4.Momentum5.Springs and Harmonic Motion6.Circular Motion	Ch. 6 Ch. 4, 5, 7 Ch. 9-12 Ch. 13-14, 16 Ch. 15 Ch. 8
II.	Rotat A. B. C. D. E. F.	 tional Kinematics and Dynamics Rotational terminology and kinematics Rotational analogs 1. Moment of inertia and parallel axis theorem 2. Torque Rotational energetics Rotational dynamics 1. Real pulleys 2. Rolling without sliding Angular momentum and Conservation of Angular momentum Gyroscopic precession 	Ch. 17 Ch. 17 Ch. 17 Ch. 19 Ch. 18
III.	Orbit A. B. C. D.	 tal Mechanics and Gravitation Historical Developments of Astronomy and Heliocentric Model Kepler's Laws and Newton's Derivation of Universal Gravitation Gravitational Potential Energy and Orbital Energies Orbital Calculations 1. Circular 2. Ellliptical a. Energy method b. Conservation of Angular Momentum 3. Transfer orbits and Escape velocity 	

IV. Mathematical Methods and Applications

- A. Linear regression, trendlines and spreadsheet functions
 - 1. Nuclear decay simulation
 - 2. Period dependence for spring-mass oscillator
- B. Differential calculus
 - 1. Simple harmonic motion and parametric equations
 - a. Spring-mass systems (horizontal and vertical)
 - b. Physical and simple pendulums
- C. Integral calculus
 - 1. Laminar viscous friction
 - 2. Kinematics
 - 3. Numeric approximation and integration techniques
 - 4. Work integrals

V. Special Relativity

- A. Simultaneity and Time Dilation
- B. Length Contractions
- C. Non-Relativistic (Galilean)Transformations and Relativistic (Lorentz) Transformations
- D. Relativistic Mass and Its Consequences
 - 1. Rest energy and Relativistic Kinetic Energy
 - 2. Nuclear transformations and Mass defect

VI. Thermodynamics

- A. Statistical Thermodynamics and Ideal Gas Law
- B. PV-Work
- C. Isotherms and Adiabats
- D. Molar Heat Capacities and Heat
- E. First Law of Thermodynamics
- F. Thermodynamic Cycles and Efficiency
- G. Otto, Diesel and Carnot Cycles