AP Physics B Syllabus

Text : Physics , Walker, 1st Edition, Prentice Hall
Supplementary texts
Ranking task Exercises in Physics, O'Kuma et al, Pearson
Cracking the AP Physics, Leduc, Princeton Review
Voodoo Science, Park, Park, OUP
The Prism and the Pendulum, Crease, Random House

About the AP Physics B Course:
(Class/Labs meets M-F, 55 min each, 18 weeks/ semester, 4 semesters (2 years in total)
The Advanced placement Physics B is an algebra-based course in general Physics. The syllabus is designed by the College Board. It is equivalent to an introductory algebra-based university level physics course. This course will be covered in 4 semesters and the student will have completed Physics 1-2 (Hons) in the first year. The emphasis in the course is on understanding the concepts and skills and using the concepts and formulae to solve problems. Laboratory work will be covered as an integral part of this course.

Resources
The textbook is extensively used. Readings are set from the book and problems from the book are set in class and for homework. Also questions from previous AP exams are used extensively. Ranking problems are also worked on as these type of problems increase student to student discussion and increase critical thinking. Whiteboards are used extensively in the classroom. Whiteboards increase student collaboration, critical thinking, and Socratic discussion allowing a group of students to pointed in the correct direction for a problem without giving them the solution. Whiteboards are used both for problem solving and lab discussions. Materials are used from the ASU modeling course. In general, labs are completed first, theory afterwards increasing student comprehension and enjoyment of physics.

Critical Thinking
Critical thinking is a integral part of the course. Lecture is kept to a minimum and students are expected to participate in group and class discussions about the topic under study. As much as possible equations and conceptions are student derived from previous inquiry labs. Often practicum problems are set where groups of students are given a physical problem which they have to solve using little help form the teacher such examples are
1) The time and position of a collision between two moving vehicles
2) Where will a ball land (Projectile motion)
3) The period of a flying pig (Circular motion)
4) How to make a simple electric motor
5) How does a leaf electroscope work
6) How does an electrophorus work
7) The time for an Atwood's machine to fall.
8) Deriving the mass of a truck using Newton's 2nd Law
9) Analyzing a toy roller coaster

These are always very successful as students see the application and success of physic's concepts

Evaluation:

Quizzes	40%
Homework	20%
Lab	20%
Final exam	20%

Calendar

1st semester

Weeks 1-2 Scientific method, graphing **Chapter 1**

Independent, dependent variables, analyzing data

Weeks 2-4 Constant velocity **Chapter 2**

Graphical, algebraic analysis

Weeks 5-9 Constant acceleration **Chapter 2, 3**

Graphical, algebraic analysis

Weeks 10-14 Newton's Laws **Chapter 5, 6**

Static equilibrium
Introduction for force is 1-D, 2-D, types of force, force diagrams
Mass and weight
Newton's 3rd Law(Two body interactions)
Atwood machines(modified and full)
Constant acceleration, friction(static and kinetic), inclined planes
Newton's 2nd Law

Weeks 15-16 Projectile motion **Chapter 4**

2-D analysis of motion

Weeks 17-18 Circular motion and gravity **Chapter 6, 12**

Planetary motion, Newton's Law of Gravity

2nd Semester

Weeks 1-4 momentum **Chapter 9**

Impulse- momentum theorem
Conservation of linear momentum
Elastic and inelastic collisions

Weeks 5-9 energy **Chapter 8**

Conservation of energy
Gravitational potential energy, kinetic energy, thermal energy
elastic energy, chemical energy
Work/energy theorem

Power

Weeks 10-12 electrostatics, conductors, insulators **Chapter 19**

Coulomb's Law, Electric Field

Weeks 13-15 electric current **Chapter 21**

Ohm's law, serial/parallel circuits

Weeks 16-17 magnetism, electromagnetic induction **Chapter 22**

Magnetic fields due to a straight wire and solenoid
Force of a magnetic field on a moving charge
Force of a magnetic field on a current carrying wire

Magnetic flux, Faraday's and Lenz's Law

Weeks 18 waves **Chapter 14**

Longitudinal, transverse
Frequency, wavelength, speed, period relationships
Doppler Effect
Musical instruments

3rd semester

Weeks 1-3 optics **Chapter 25-28**

reflection, refraction, lenses, mirrors
diffraction, interference, polarization
electromagnetic spectrum
Snell's Law

Weeks 4-6 Atomic physics **Chapter 30-32**

Photoelectric effect,
energy and momentum of photon
DeBroglie Relationship
Alpha, beta, gamma decay
Fusion, fission

Weeks 7-9 Fluid Mechanics **Chapter 15**

Pressure, Archimedes principle, buoyancy, Bernoulli's equation

Weeks 10-12 oscillations SHM **Chapter 13**

Pendulum, mass and spring system

Weeks 13 Thermal physics **Chapter 18**

Ideal gas laws, 1st Law of thermodynamics
2nd Law of Thermodynamics
Heat cycle

Weeks 14-16 Potential, review electric current, magnetism, capacitors Chapters 19-23

Electric potential and electrical potential energy
Capacitance(Calculation, energy of a capacitor, applications)

Weeks 17-18 review momentum, energy **Chapter 8,9**

4th semester

Weeks 1-18 review
This includes working on previous AP exams, reviewing labs that interest students and that come up while looking at past AP questions. Working on and discussing previous Physics bowl exams.
Black hole unit
Sound unit
Rail gun unit

Labs

Each student is required to keep a lab book to records and write lab reports. Each lab will consists of observations, purpose(hypothesis), diagrams, procedure, data, data analysis and conclusions. Students are taught to recognize variables, to discuss ways to change and control variables, and to interpret outcomes Labs are used to derive physical relationships. Lab books are

graded individually. Graphs are both hand drawn and checked using software.. There are discussions in the lab report of possible experimental errors
A number of labs use Pasco equipment, the classroom has 10 computers with Pasco interfaces and the software Data Studio and Graphical Analysis. The optics labs use Pasco optics kits. Simulations are used primarily from the PHET web site.

Semester 1/2
Pendulum lab, Relationship between length, mass, angle, period. Student hands on
Circle lab(slope, variables, equations) Relationship between diameter and circumference. Student hands on (180 mins)
Constant velocity lab (part 1 and 2). Relationship between distance and time. Student hands on(180 mins)
Acceleration Lab (Galileo's inclined plane) Relationship between distance and time (extension velocity and time. Student hands on(180 mins)
Force vs. mass lab Relationship between mass and weight (Fg). Student hands on(60 mins)
Modified Atwood's Lab Relationship between mass, acceleration and force. Student hands on (120 mins)
Friction Lab Relationship between area, normal force, surface types and friction force(static and kinetic. Student hands on (120 mins)
Projectile motion Lab Relationship between horizontal and vertical distance and time. Student hands on(video analysis) (120 mins)
Rotational Motion Lab Analyze rotational motion(conceptual discovery). Student hands on (60 min)
Momentum lab Analyze elastic, inelastic and explosive interactions. Student hands on (120 mins)
Spring Lab Relationship between force and change in spring length for different springs. Student hands on (60 mins)
Energy Lab (Roller coaster) Analyze the energies changes, friction, power of a toy roller coaster Student hands on (60 mins)
Sticky tape (electrostatics) Find the properties of the electric force (+, - charge, distance, polarization). Students hands on (60 ins)
Electroscope/Electrophorus Lab Analyze and explain the operation of the devices. Students hands on (60 mins)
Coulomb's Law Relationship between charge, distance and force. Simulation (60 mins)
Ohm's Law Relationship between current, voltage and resistance. Students hands on (180 mins)
EMI lab Relationship between magnetic flux and current. Simulation (60 mins)
Waves/slinky Lab Relationship between frequency, velocity and wavelength. Simulation (60 mins)

Semester 3/4
Optics lab (reflection, refractions, lenses, diffraction)
Students hands on (300 mins)
Plotting Potentials Lab Relationship between distance and voltage. Students hands on (60 mins)
Buoyancy lab . Find the density of various objects using Archimedes principles. Students hands on (60 mins)
Thermal heat capacity lab Relationship the heat capacity of various objects. Students hands on (60 mins)
Capacitor energy Lab Relationship between voltage and energy. Students hands on (60 mins)

Photoelectric effect. Simulation (60 mins)
Momentum Lab (review) student hands on (60 mins)
A number of mechanics labs as reviews