AP® Physics-2
The Mississippi School for Mathematics & Science

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TEXTBOOKS: Serway & Vuille, *College Physics 9ed*, Brooks/Cole, 2011.
Enrichment Texts: OpenStax College, College Physics. OpenStax College. 21 June 2012.
Hewitt, *Conceptual Physics 9ed*, Pearson, 2001.

DESCRIPTION: AP® Physics-2 is an algebra and trigonometry based course which provides a college-level introduction to the topics of a university's second semester physics course. Successful completion of this course will provide the student with a solid foundation in the topics of fluid statics and dynamics, thermodynamics, kinetic theory, PV diagrams and probability, electrostatics, RC circuits, magnetic fields, electromagnetism, physical optics, geometrical optics, introductory atomic and quantum theory, relativity and nuclear physics. Critical thinking and reasoning skills are developed through inquiry-based laboratory experiences. The lab-based course is designed to prepare students to take the AP® Physics-1 examination, which is administered each May. In order to foster critical thinking skills necessary to pursue a career in science or engineering, the course includes two separate hands-on components (Labs and Extended Design Projects) which utilize guided inquiry and student-centered, team-based design of experiments, presentation of design results and scientific argumentation. The class will meet for lecture on Monday, Wednesday & Fridays for one hour each day, and the lab will meet on Tuesdays or Thursdays for 1.5 hours each week. (Lab time constitutes 33% of the total in-class contact hours for the course.)

PREREQUISITE: AP® Physics-1

GRADING SCALE: A: 90 – 100 B: 80 – 89 C: 70 – 79 NC: 0 – 69

CHRONOLOGY:
Weeks 1-4: Fluid statics and dynamics
Weeks 5-7: Thermodynamics
Weeks 7-8: Kinetic theory
Weeks 9-10: PV diagrams and probability
Weeks 11-12: Electrostatics
Weeks 13: RC circuits
Weeks 14-16: Magnetic fields
Weeks 17-18: Electromagnetism
Weeks 19-20: Light and Special Relativity
Weeks 21-24: Light and physical optics
Weeks 25: Geometrical optics
Weeks 26-28: Introductory atomic theory
Weeks 29-31: Quantum theory
Weeks 32-34: Nuclear physics & nuclear energy
Weeks 35: Content Exam Review
Weeks 36: Short intro to General Relativity & programming GPS clocks

ASSESSMENT
Homework / Class-Work: Homework will consist of reading, taking notes, answering conceptual questions and working problems. "Problem Sets" will be assigned from each chapter. Both the teacher and students will model many of these problems in class. In addition to lecture, class-work also will include "whiteboard problem solving" where each table is given its own 3'x4' whiteboard and one marker. When needed the teacher can offer suggestions, but the student teams must communicate effectively as a team and bring all their problem solving skills to bear upon the problem at hand. When completed, the team will present their solution before the classroom. The homework & class-work average will count 20**%** of the nine-weeks grade.

Quizzes: In order to reinforce the reading assignments, one out-of-class, computer-based "Conceptual Quiz" per unit will be averaged into the homework grade. The student may work the "Conceptual Quiz" as many times as he or she likes in order to score a higher score.

Labs: In order to foster critical thinking skills necessary to pursue a career in science or engineering, students will complete a hands-on lab component which utilizes guided inquiry and student-centered, team-based design of experiments. Lab grades will consist primarily of an inquiry-based design of experiment, followed by a collection of data and writing up the methods, results and conclusions in a professionally acceptable format. By the semester's end, the student will have generated a portfolio of experimental designs and lab write-ups. The lab average will count 20**%** of the nine-weeks grade. At least twenty or more of the following investigations (labs) will be performed during the year:

1. Water discharge rates in a flume
2. Archimedes' Principle
3. Torricelli's Theorem
4. Heating efficiency
5. Combined gas laws
6. Latent & specific heat
7. Friction energy transfer apparatus
8. Operation of a heat engine
9. Thermal conductivity
10. Electric Fields & Equipotentials in 2D
11. Ohm's Law, Ohmic & non-Ohmic Materials
12. Parallel-Plate Capacitor Forced Decay Rates on the Oscilloscope, Estimating Capacitance
13. V-I Curves and analog component response
14. Potentiometers & Voltage Divider Circuits
15. High-Pass, Low-Pass, Band-Pass RC Filter design
16. LRC Circuits & Underdamped Voltage/Current Decay
17. Power Factor Correction in LRC Systems
18. Electric Motor
19. Magnetic Field of a Slinky
20. Measuring the Speed of Microwaves
21. Plank' constant with LED and the V/I curve
22. Spherical mirrors and optical instruments
23. Spherical lenses and optical instruments
24. Diffraction Grating Calibration with optical lasers
25. Diffraction and resolution limits for optical instruments
26. Polarization of Light and Chirality
27. Malus' Law for polarizing film
28. Nuclear Safety
29. Decay of Pb-210 and the Wilson Chamber
30. Nuclear decay and the Geiger-Mueller tube
31. Experimental Procedure & Identification of Systematic Variances

Projects: In order to foster critical thinking skills necessary to pursue a career in science or engineering, students will complete team-based engineering design units which utilize guided inquiry and student-centered, team-based engineering design projects. These extended engineering design projects will require the student teams to bring all their physics knowledge to bear upon a problem of engineering design and also may incorporate the use of numerical methods, statistical methods and computer programming in order to complete the team-based designs. Two extended "Engineering Design" projects will be assigned during the school year leading to team-based PowerPoint presentations of engineering designs and classroom-collaborative scientific argumentation and critique of engineering designs. The Projects will be averaged into the lab average. At least two of the following design projects will be performed during the year:

1. Computer visualization of electric fields and equipotential surfaces using Maple/Mathematica
2. Dobsonian optical telescope design and testing
3. Pump testing and slug testing from hydrology.
4. Power Factor Correction in LRC Industrial Systems
5. Design of well-filtered DC Power Supply
6. Design of multi-stage transistor amplifier
7. Programming of on-board satellite GPS clocks: special & general relativity

Unit Tests: There will be 2 – 4 tests each nine-weeks. These tests will cover the material assigned for study on the particular topics. The average of these tests will count 60**%** of the nine-weeks grade. Missed unit tests will be made up no later than 5 days after the test is given.

Semester Exam: The semester exam shall count 20% of the semester grade. Each nine-weeks grade shall count 40% of the semester grade.

Academic Dishonesty The Physics Department defines academic dishonesty to be any action in which a student claims any work done by another person or machine as his or her own work. Some examples of academic dishonesty are as follows:

- Copying another person's homework, lab report, etc.
- Putting a student's name on a project in which that student has not done an equal part
- Reporting on an assignment that has not been read, such as a book report, extra-credit reading etc.
- Using unauthorized notes or another person's work on tests
- Discussing material on test with others who have not yet taken the test
- Plagiarism

Honor Code In this course, anything the student turns in for a grade must be "pledged" according to the following honor code:

"I promise that I have neither given nor received any unauthorized help on this assignment."

Simply writing "**I promise**" near your name will serve as shorthand for the full pledge. To clear up any confusion, note that any help at all on a test is unauthorized. On homework and labs, students are urged to give and receive help from others and to work in small groups in order to learn, as long as copying is not the result. Help each other and compare answers on homework and other assignments done outside of class. Discuss those answers on which you disagree, changing your answer if you choose. The goal is for you to become an independent learner, capable of group interaction. However, after receiving help on a problem outside of class from another student, keep in mind that if you have the answer but do not understand how to get it yourself, then you have been helped to cheat and not to learn.