

UNIVERSITY OF PUERTO RICO
RÍO PIEDRAS CAMPUS
COLLEGE OF NATURAL SCIENCES
DEPARTMENT OF PHYSICS

Title: University Physics for Scientists & Engineers Majors: Part II

Code: FISI 3172 Section OU1 PHYS 3172

Number of Credits: 4

Prerequisites: PHYS 3171-3173 (Physics I and Physics Laboratory I)

Co-requisite: PHYS 3174 (Physics Lab II), MATH 3152 (Calculus II)

Description

Second part of a calculus-based introductory Physics course for majors, designed to give them a sound background in Classical Physics that prepares them well for taking upper level Physics courses. It includes: Angular Momentum: general rotation and the cross product of vectors, conservation of angular momentum; Electrons, Protons and charge; atoms, molecules and Batteries; conductors and insulators. Electric Charges and associated Electric Fields, from molecular dipoles and between charged separated metal plates; Electric Potential, Capacitance and electric potential energy; The electron Gun and electron deflection in a cathode ray tube; Current and Resistance; Kirchhoff Laws and Circuits; Magnetic Fields, magnetic force and Ampere's Law; the electric motor; Faraday's Law of Electromagnetic Induction; The electric generator, AC vs DC current and the transformer; Inductance, the inductor as a circuit element; Maxwell's correction to Ampere's Law, Maxwell's laws and Electromagnetic Waves; Hertz's electromagnetic waves and the development of Radio. (Geometrical Optics; Interference, Young's Double Slit experiment; Refraction and Diffraction all will be covered in the associated 3174 Laboratory course.) FISI 3172 provides the tools for the students to develop: (1) a basic understanding of Classical Physics laws and their application; (2) proficiency with the mathematics used to solve Physics problems; (3) problem-solving skills and strategies; (4) ability to communicate in writing and orally their understanding of Physics concepts and their application to problem solving.

Objectives

Through this course, the students will:

- Read the sections of the book corresponding to the topics of the course and attempt solving problems before they are discussed in class, in order to bring specific difficulties and questions for class discussion.
- Solve Physics problems independently in order to apply and show their understanding of basic Physics laws discussed in class.
- Apply calculus concepts to the solution of Physics problems
- Practice and develop problem-solving skills and strategies showed in class and in textbooks
- Communicate their understanding of Physics concepts and of their application by detailing their reasoning in written problem solutions and during class verbal communication

(syllabus continuation: FISI 3172)

Course Content and Time Distribution

- Week 1: Chapter 11 Angular Momentum
Week 2: Chapter 13 Fluids
Week 3: Chapter 14 Harmonic Oscillations
Week 4: second order linear differential equations with constant coefficients
The damped Oscillator and the Driven oscillator and Resonance
Week 4: EXAM I (Chapters 11, 13, 14)
Week 5: Chapter 21...charge, conductors, insulators...Batteries, Electric Field of
Molecular dipoles and charged Plates
Week 6: Chapter 24 (the Capacitor) Chapter 23 Electric Potential (Volts)
Electric potential energy, the electron Gun, electron deflection
Week 7: Chapter 22 Gauss' Law
Week 8: EXAM II 21, 22, 23, 24(parallel plates only)
Week 9: Chapter 25, 26 current, Ohm's law, Kirchhoff circuit law
RC circuit (exponential decay, growth)
Week 10: Chapter 27 The Magnetic Field, Lorentz force, motion of a charged
particle in a magnetic field, Ampere's Law, discovery of the electron
Week 11: Chapter 28 and
EXAM III (25, 26, 27 and 28)
Week 12: Chapter 29 Faraday's Law of electromagnetic Induction, the generator
The transformer. AC Circuits
Week 13: Inductance as a circuit element. Chapter 30 Maxwell's correction to
Ampere's Law, Maxwell's Equations, The electromagnetic wave and Light.
Week 14: The LC Oscillator, Hertz Waves and Radio
Week 15 Summary of Classical mechanics and Electromagnetism
Finals EXAM IV as schedules by the registrar

Instructional Strategies

The professor combines discussion, lectures, audiovisual materials, and demonstrations to convey the content of the course. Early in the semester, the students are assigned problems sets that give them experience in problem solving and prepare them for the examinations. In these problem sets, the students have to detail in writing their reasoning and their application of Physics concepts. The class discussions and laboratories (PHYS 3173) are synchronized to insure that the lab activities produce timely reinforcement of concepts discussed in class.

Minimum Required Facilities

Lecture room with audiovisual equipment and demonstration experiments available on request.

Student Evaluation

Four partial examinations (the final exam is the fourth) are given during the semester. The exams are 100 point each and $(\text{total points}/4) \times 0.85 = 85\%$ of the grade. Four problem sets are also assigned, corresponding to the topics on each exam. They each are worth 25 points. The $(\text{total points})/4 \times 0.15 = 15\%$ of the grade. The students are expected to detail in writing their understanding and the reasoning applied in the solution of the problems, in addition to the mathematical steps. Each problem set is due the day of the corresponding exam.

Grading System

The overall score is determined by calculating the percentage of points obtained by the student. Grades are then assigned according to the standard curve: 100-90% = A, 89-80% = B, 79-70% = C, 69-60% = D, 59-0% = F.

Bibliography

1. **Physics for Scientists & Engineers (volume I), Douglas C. Giancoli, Prentice Hall, 2008**
Either 3rd of 4th edition (ISBN 0-13-227358-6) is the required text.
2. Fundamentals of Physics, David Halliday, Robert Resnick, Jearl Walker, Wiley, 2002
3. Physics for Scientists & Engineers, Raymond A. Serway, Saunders Publishing, 2002

Rights of Students with Disabilities

UPR complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act 1990 (ADA) and the Commonwealth of Puerto Rico Law 51. Students receiving services through Rehabilitaci3n Vocacional must contact the professor at the beginning of the semester in order to plan for a reasonable accommodation and any required support equipment according to the recommendations given by the Oficina de Asuntos para las Personas con Impedimentos (OAPI) of the Dean of Students. Likewise, students with special needs that require some type of accommodation must contact the professor.

(syllabus continuation: Physics II, PHYS 3172)

Course Content

Week 1-2:	Thermodynamics
Week 3:	Kinetic Theory of Gases
Week 4:	Entropy
Week 5:	Electric Charges and Fields
Week 6:	Gauss' Law and Electric Potential
Week 7:	Capacitance, Current and Resistance
Week 8:	Circuits
Week 9-10	Magnetic Fields, Induction and Inductance
Week 11-12:	Electromagnetic Oscillations and Waves
Week 14:	Geometrical Optics
Week 15:	Interference, Refraction and Diffraction

Instructional Strategies

The professor combines discussion, lectures, audiovisual materials, and demonstrations to convey the content of the course. Early in the semester, the students are assigned problems sets that give them experience in problem solving and prepare them for the examinations. In these problem sets, the students have to detail in writing their reasoning and their application of Physics concepts. Each student makes an oral presentation in class of the solution of a specially assigned problem. The class discussions and laboratories (PHYS 3174) are synchronized to insure that the lab activities produce timely reinforcement of concepts discussed in class.

Minimum Required Facilities

Lecture room with audiovisual equipment and demonstration experiments available on request.

Student Evaluation

Three partial examinations and a final exam are given during the semester (15% each). Three problem sets are also assigned, corresponding to the topics of each partial exam (10% each). The students are expected to detail in writing their understanding and the reasoning applied in the solution of the problems, in addition to the mathematical steps. The professor will assign each student a unique problem to be solved independently in writing (5%) and presented orally in class (5%).

Grading System

The overall score is determined by calculating the percentage of points obtained by the student. Grades are then assigned according to the standard curve: 100-90% = A, 89-80% = B, 79-70% = C, 69-60% = D, 59-0% = F.

Bibliography

4. Fundamentals of Physics, David Halliday, Robert Resnick, Jearl Walker, Wiley, 2002
5. Physics for Scientists & Engineers, Raymond A. Serway, Saunders Publishing, 2002
6. Physics, Douglas C. Giancoli, Prentice Hall, 2002

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