

Department of Physics  
College of Natural Sciences  
University of Puerto Rico- Río Piedras Campus

FISI3016

Introduction to Modern Physics

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Number of Credits: 3

Pre-requisites: FISI 3172-3174 (Physics II, Physics Lab II)

Co-requisites: none

Professor: Dr. Antonio Martínez Collazo

Office: CNL C349

Office Hours: Tuesdays 9:00AM -12:00M

### **Description**

An introductory course in contemporary physics with emphasis on descriptive aspects. The Special Theory of Relativity. The origins of Quantum Physics: Particle properties of electromagnetic radiation, Blackbody spectrum, Photoelectric effect, Compton scattering, X-rays. Wave properties of material particles, de Broglie wave, Wave-particle duality, Uncertainty Principle. Atom models, atomic spectra, Bohr-de Broglie atom. Correspondence principle, simple ideas of wave mechanics and the Hydrogen atom and spin. Electronic configurations in atoms and the Periodic Table. Introduction to properties of condensed matter, the atomic nucleus and elementary particles.

### **Objectives**

This course is meant to introduce the students to fundamental concepts in Statistical Mechanics, Quantum Mechanics and Special Relativity. The students develop conceptual understanding of topics in Modern Physics and problem-solving techniques. After completing this course, the students are familiar with a broad range of phenomena in Modern Physics and some of mathematical tools applied to them.

### **Course Content**

- Week 1-2: Particles & Forces
- Week 2-4: Distribution Functions &  $kT$
- Week 5-6: Planck's Constant & Photon Statistics
- Week 7-8: Special Relativity
- Week 9-11: Introduction to Quantum Physics
- Week 11-12: The Schrodinger Equation
- Week 13: Hydrogen and Hydrogen like atoms
- Week 14-15: Molecules, Conductors, Insulators and Semiconductors

### **Instructional Strategy**

The course is offered online synchronously, at class time LW 10:00 AM-11:20AM. The Google Meets platform will be used. Cameras and microphones must be turned off during class. The microphone can be activated to ask questions. The classes will be recorded and will be available through MOODLE given the approval via email of the enrolled students. The recording of the lectures should not be shared outside the context of the classroom. The notes generated by the teacher during the class will also be available in MOODLE. I will be available at the indicated time to clarify doubts about the material covered in class given prior communication to agree on the medium, i.e. by email or Google Meets. The main instructional tool in this class is lecturing. Homework problems are assigned and discussed in class.

### **Minimum Required Facilities**

You will need access to a computer or smart phone with access to the internet. If you have trouble with either one of these requirements please let the professor know as soon as possible.

### **Student Evaluation**

Three exams are given, worth 25% of the grade each. Homework assignments given during the semester are graded for 25%. The exams will be administered during the Wednesday class and will be sent by email 10 minutes before the meeting time. The evaluations will proceed in the same way in which they are administered in person, that is, the use of any external resources such as (but not limited to) the textbook and consultations with third parties (individuals or virtual) is not allowed except when explicitly stated. If an electronic proctoring system is available, we will use it for exams.

### **Bibliography**

1. Modern Physics from a to Z, John Wiley & Sons, James Rohlf, 1994.
2. Quantum Physics of Atoms, Molecules Solids, Nuclei, and Particles, Eisberg & Resnick, John Wiley & Sons, 2nd edition, 1985.
3. Concepts of Modern Physics, Arthur Beiser, 5th Ed., McGraw-Hill, 1995.

**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.

**Academic Integrity:** Complete and absolute academic honesty is expected of the student. If you have any questions about the material, you should consult your teacher during office hours or by email. Any student caught committing any act of academic dishonesty will receive zero points in the work in question and a disciplinary committee will be summoned to see the case and this can lead from a warning to the expulsion of the student from the UPR, depending on the lack committed. This policy also applies to reports and other assignments for this course.

**Gender Equity:** "The University of Puerto Rico prohibits discrimination based on sex and gender in all its forms, including sexual harassment. According to the Institutional Policy against Sexual Harassment at the University of Puerto Rico, Certification No. 130, 2014 -2015 of the Governing Board, if a student is being or was affected by conduct related to sexual harassment, they can go to the Office of the Student Procurator, the Dean of Students or the Compliance Coordinator with Title IX for orientation and/or file a complaint."