



**Department of Physics and Engineering Physics
Faculty of Science
Obafemi Awolowo University, Ile-Ife**

Course Outline for PHY 205

Course Title: Introductory Modern Physics

Course Code: PHY 205

Credit: 03

Course Coordinator: Prof Joshua O. Ojo

Course Instructor(s): Prof Joshua Ojo and Dr Steven Olukotun

Course Tutor(s): None

Course Description

This is an introduction to Modern Physics. Modern Physics refers to the new body of knowledge in Physics acquired beginning from around 1900. This is characterized mainly by Quantum Mechanics and Relativity. In PHY 205 we deal with QM while PHY 206 will address Relativity.

There's virtually no aspect of scientific work today that does not depend somehow on quantum mechanics. Most equipment will involve reading and interpreting spectra (molecular, atomic, or nuclear) all which require some basic understanding of QM.

In this class we shall examine the fundamental concept of quantization (i.e. physical quantities coming in packages with the physical variables associated with them restricted to certain discrete values.) This phenomenon is noticeable only at extremely small scales, (atomic and sub-atomic levels) and we need it to understand the structure of atoms and subatomic particles including the processes associated with them: emission, absorption and other interaction of electromagnetic radiation with matter.

The class will finally introduce us to the wave-particle duality concept, which allows us to determine properties of atomic and subatomic systems by treating them as waves to which we can apply the Schrodinger Wave equation.

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Prof J.O. Ojo will be spending about half the lecture periods treating the basic concepts, while Dr S.F. Olukotun will treat the application to atomic and other stable systems using wave mechanics (Schrodinger Wave Equation)

The main Textbook to be used will be Concepts of Modern Physics by Arthur Beiser; while College Physics (Serway) will serve as supplementary text. Voice-embedded Power point presentation of lecture materials and other Materials together with assignments will be uploaded on Google Classroom on weekly basis. Summary of each Module will be posted as voice clips on WhatsApp .

Overall Learning Outcomes:

A solid appreciation of the concept, principles, and applications of Modern Physics for self and national development.

Specific Objectives for the Course

1. Get students to appreciate the important concept of quantization and the landmark experiments associated with its origin
2. Understand the particle behavior of electromagnetic waves; and interaction of radiation with matter in general
3. Application to atoms and stable systems, particularly concept of absorption and emission spectroscopy
4. Understand the wave behavior of matter, and application of wave mechanics to simple situations.

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Course Outline for PHY 205: INTRODUCTORY MODERN PHYSICS

PROF JOSHUA OJO

The origin of quantum theory.

- Blackbody radiation
- Wien's Law
- The Rayleigh-Jeans theory
- Planck's theory

Electrons and quanta

- Cathode rays
- The specific charge of electrons
- The charge and mass of electrons

Particle behavior of electromagnetic radiation

- Photoelectric effect
- X-rays
- Compton effect
- Pair production and annihilation

The atomic nucleus

- Thomson's model
- Rutherford's model
- The size of the nucleus

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DR STEVEN OLUKOTUN

Wave behavior of matter

- De Broglie hypothesis
- Electron diffraction
- Wave-particle duality
- The Uncertainty Principle of Heisenberg

Bohr theory of atomic structure:

- Atomic spectra
- Wilson-Sommerfeld quantization rules
- Sommerfeld's relativistic theory
- The correspondence principle
- Problems of the old quantum theory

Schrodinger wave equation and simple applications.

The Pre-requisite for this course is PHY 101

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