COURSE OUTLINE

PHYS 202 – MODERN PHYSICS

Prepared By: Dr. Lawretta Ononye
A. **TITLE**: MODERN PHYSICS

B. **COURSE NUMBER**: PHYS 202

C. **CREDIT HOURS**: 3

D. **WRITING INTENSIVE COURSE**: No

E. **COURSE LENGTH**: 15 weeks

F. **SEMESTER(S) OFFERED**: Fall/Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY**: 3 lecture hours per week

H. **CATALOG DESCRIPTION**: The atomic view of matter, Bohr model, relativity, particle properties of waves, wave properties of particles, introduction to quantum mechanics, quantum theory of the hydrogen atom, the solid state, introduction to Fourier series and integrals and statistical mechanics.

I. **PRE-REQUISITES/CO-REQUISITES**:  
a. Pre-requisite(s): University Physics II (PHYS 133) or permission of the instructor.  
b. Co-requisite(s): None

J. **GOALS (STUDENT LEARNING OUTCOMES)**:  
By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
</tr>
</thead>
</table>
| a. Solve motion problems using the special theory of relativity.                 | 1. Communication  
2. Crit. Thinking  
3. Prof. Competence |
| b. Calculate relativistic energy and momentum.                                    | 1. Communication  
2. Crit. Thinking  
3. Prof. Competence |
| c. Explain the duality of waves and particles.                                    | 1. Communication  
2. Crit. Thinking  
3. Prof. Competence |
| d. Appraise the quantum mechanical view of physics as compare to classical mechanics. | 1. Communication  
2. Crit. Thinking  
3. Prof. Competence |
| e. Explain the basic tenets of quantum theory and calculate solution to quantum mechanical problems using Schrodinger’s equation. | 1. Communication  
2. Crit. Thinking  
3. Prof. Competence |
| f. Demonstrate an understanding of physics application of scientific data, concepts and models. | 1. Communication  
2. Crit. Thinking  
3. Prof. Competence |

L. **REFERENCES**: None

M. **EQUIPMENT**: Technology enhanced classroom

N. **GRADING METHOD**: A-F

O. **MEASUREMENT CRITERIA/METHODS**:
   - Exams
   - Quizzes
   - Homework
   - Participation
   - Project

P. **DETAILED COURSE OUTLINE**:

I. Review of Classical Physics
   - Forces
   - Momentum
   - Work-energy
   - Field forces
   - Electric and magnetic fields
   - Waves

II. Special Theory of Relativity
   - Invariance of the speed of light in inertia frames
   - Length contraction
   - Time dilation
   - Doppler shift
   - Relative velocities
   - Mass and energy equivalence

III. Particle Nature of Waves
   - Photo electric effect
   - Black body radiation
   - Compton effect.
   - Bremsstrahlung

IV. Wave Nature of Particles
   - DeBye waves
   - Electron diffraction
   - Neutron diffraction

V. Quantum Mechanics
   - Quantum theory.
   - Schrodinger equation
   - Step function
   - One, two, and three –dimensional wells
   - Simple oscillator
VI. The Hydrogen Atom
   A. Hydrogen spectrum.
   B. Bohr model.
   C. Schrodinger’s equation for Hydrogen – Separation of variables
   D. Eigen values for hydrogen
   E. Pauli’s exclusion principle
   F. Selection rules

VII. Statistical Mechanics
   A. Statistical methods.
   B. Boltzmann distributions
   C. Bose-Einstein distribution
   D. Fermi-Dirac distribution

VIII. Solid State
   A. Types of bonding
   B. Periodic structure of crystals
   C. Free electron theory
   D. Bond theory
   E. Semi-conducting diodes and transistors

IX. Nuclear Physics
   A. Nuclear structure
   B. Radioactivity
   C. Fusion and fission
   D. Chain reactions

Q. **LABORATORY OUTLINE:** N/A