School of Engineering and Physical Sciences
Department of Mathematics and Physics

Course Name	Modern Physics I
Course Code	PHY 250
Course Credit Hours	3
Prerequisite	PHY 107, MAT 130
Course Objective	This course is designed to introduce the microscopic world works by going through some of the most important discoveries and mathematical foundations.
Course Description	Students develop an understanding of relativity and the mathematical description of the microscopic world. They learn how the wave and particle framework work simultaneously in the microscopic world. Students also learn to apply the Schrödinger's Equation and extract meaningful physical quantities by solving the equation.
Method(s) of Instruction(s)	Interactive lectures

COURSE CONTENT BY TOPIC

Module #1	**Relativity:** Lorentz Transformation, Special Relativity, Time Dilation, Doppler Effect, Length Contraction, Relativistic Momentum, Mass, Energy, Spacetime
Module #2	**Particle Properties of Waves:** Electromagnetic waves, Blackbody Radiation, Photoelectric Effect, X-ray Diffraction, Compton Effect, Pair Production, Photons and Gravity, Gravitational Waves
Module #3	**Wave Properties of Particles:** De Broglie Waves, Waves of Probability, A General formula for Waves, Phase and Group Velocities, Particle Diffraction, Uncertainty Principle and its Application
Module #4	**Atomic Structure:** Rutherford Scattering, Atom, Electron Orbits, Atomic Spectra, Bohr Atom, Energy Levels, Correspondence Principle, Atomic Excitation, Laser
Module #5	**Schrödinger's Equation:** Wave Equation, Time-Dependent Schrödinger's Equation, Linearity and Superposition, Expectation Value, Operators, Eigen Values and Eigen functions, Particle in a Box, Finite Potential Well, Tunnel Effect, Harmonic Oscillator
Module #6	**Hydrogen Atom:** Schrödinger's Equation for Hydrogen Atom, Quantum Numbers, Electron Probability Density, Radiative Transition, Selection Rules, Zeeman Effect
Actual contact hours: Lecture : 3 hours per week, 36 hours per semester	

TEXTBOOK REQUIREMENT

1. Concept of Modern Physics, Arthur Beiser
2. Modern Physics, Kenneth Krane
3. Introduction to Modern Physics (Theoretical Foundations), John D. Walecka

ASSESSMENT STRATEGY AND GRADING SCHEME

NSU's grading and performance evaluation policies will be followed in assigning your grade. Please note that all final grades are subject to departmental review and approval. A guideline of course assessment is as follows-

Class Attendance	Assignments	Quiz	Midterm	Final
5%	10%	20%	30%	35%

MAPPING OF COURSE OUTCOMES

CLO-#	Outcome Types	Bloom's Taxonomy level (C- Cognitive, A- Affective, P- Psychomotor)	Delivery Method	Assessment Tools	
CLO #1	Understand the mathematical basics of relativity.	C2, P2	Lecture and Discussion	Quiz and Assignment	Midterm Exam
CLO #2	Describe how the particle behavior is associated with the general wave.	C2, P3	Lecture and Discussion	Quiz and Assignment	
CLO #3	Explain how the wave behavior is associated with matter, especially in the microscopic world.	C2, P3	Lecture and Discussion	Quiz and Assignment	
CLO #4	Interpret the atomic structure and energy levels.	C2, P4	Lecture and Discussion	Quiz and Assignment	Final Exam
CLO #5	Apply Schrödinger's Equation and understand the linearity and superposition principle.	C3, P3	Lecture and Discussion	Quiz and Assignment	
CLO #6	Understand the eigen values and eigen functions of different systems.	C2, P2	Lecture and Discussion	Quiz and Assignment	
CL0 #7	Explain the quantum mechanical behavior of hydrogen atom.	C2, P2	Lecture and Discussion	Quiz and Assignment	