WINTHROP UNIVERSITY
PHYS 301 Course Syllabus
Department of Chemistry, Physics, & Geology

Semester: Fall 2024 **Course:** PHYS 301 – Modern Physics
Credit hours: 3 **Pre-requisite:** A grade of C or better in PHYS 212 or PHYS 202.

Professor: Dr. Fatima Amir
Office: 203, Sims, Office Hours: W 1-3, or by appointment.
Phone: 323 4935, E-mail: amirf@winthrop.edu

Textbook: No book is required for this class

Attendance: Independent Study

Course Description:

An introductory modern physics course covering relativity, early quantum theory and basic quantum mechanics with selected applications to atomic, nuclear, solid state, and particle physics. The course emphasizes understanding of fundamental physics concepts and principles as well as the development of conceptual and analytical problem solving skills by using physics concepts, principles, and mathematics.

Course Objectives:

- Develop an understanding of modern physics' role as the most basic of the sciences.
- Demonstrate an understanding of the history of scientific discovery.
- Learn the introductory modern physics concepts associated with special relativity, quantum physics, atomic physics, nuclear physics, and particle physics.
- Gain an understanding of modern physics' role in technology and to discuss the strengths and limitations of science.
- Develop conceptual and analytical problem solving skills.

University-Level Competency:

Modern physics introduces students to the role of scientific reasoning in solving introductory modern physics problems (e.g. describing relativity and calculating time dilation and length contraction, use of quantum mechanics in dealing with sub-atomic particles, and using particle physics in the understanding of the origin of the universe and its future. They will also be introduced to the history of scientific discovery (e.g., topics and devices are introduced with historical perspectives) and learn that the theories in physics evolve into laws after continuous re-evaluations and arguments. In addition they will see how the scientific advances made in a

laboratory transforms into useful technological devices (e.g., the development of the transistor from vacuum tube to silicon chip).

Attendance: Although roll is not formally taken in class, I strongly recommend regular attendance. The course has a significant component of interactive learning, and the activities done in class reinforce the material discussed. If there is a reason that you must miss class, please talk with me to make arrangements to cover the material. The attendance policy described in the Winthrop University undergraduate catalog will be followed.

Class Policy:

Homework: You will be assigned problems every week. These are not take-home exams. You are encouraged to work the problems with your classmates as long as there is contribution from each one of you.
Your work is due on time, with the exception of reasonable **documented** excuses. ***Late work will be docked 50% of face value and 100% after solutions have been posted.***

For any questions regarding assignment or any topics covered in class, you are encouraged to come for help during office hours. If you cannot make office hours, please email me, and I can meet you any time that works for you.

Academic Dishonesty/Plagiarism: Collaboration on assignments is welcome, but please keep in mind that your final, turned-in work should be your own and not copied. However, no form of cheating/plagiarism will be tolerated in this class. If anyone is suspected of academic dishonesty, I will privately speak with them in an attempt to reach a solution to whatever the problem is. If anyone is without doubt determined to be cheating on a given assignment/test and no resolution can be offered, *negative credit will be given*. In extreme cases, the Department and/or College administration will become involved. The policy on student academic misconduct is outlined in the "**Student Conduct Code Academic Misconduct Policy**" in the online *Student Handbook*:

(http://www2.winthrop.edu/studentaffairs/handbook/StudentHandbook.pdf)

Course Communication:

1. Be sure to check your Winthrop email account daily, as I may send out course related announcements that will come *only* to Winthrop email addresses.

2. If you email me, please be sure to use your Winthrop email account I will respond to email within 24 hours except from Saturday morning through Sunday afternoon when my response may be slower.

Students with Disabilities/Need of Accommodations for Access: Winthrop University is committed to providing access to education. If you have a condition which may adversely impact your ability to access academics and/or campus life, and you require specific accommodations to complete this course, contact the Office of Accessibility (OA) at 803-323-3290, or,accessibility@winthrop.edu. Please inform me as early as possible, once you have your official notice of accommodations from the Office of Accessibility.

Syllabus change policy: The instructor will make changes to this syllabus as deemed necessary for the progression of the course

Exam Policy: There are three exams and a final paper for this class. If you are going to miss a test, you **must notify me in advance (preferably one week) so alternate arrangements can be made. If you miss a test and your absence is not excused, a grade of zero points must be assessed for that particular piece of work.** You must take all the exams as well as the final exam in order to pass the course.

CAS diversity and inclusion statement: At Winthrop University in the College of Arts and Sciences, diversity, equity, and inclusion are essential to our academic mission and institutional identity. We value and see others as whole people. Our faculty, staff, and students work together to create a community where people of all races, ethnicities, genders and gender identities, sexualities, socioeconomic classes, cultural backgrounds, nations of origin, ages, religions, political perspectives, abilities, and body types can truly thrive.

Grading:
Homework 25%
Three exams 15% each
Final Exam 30 %

The letter grade will be assigned as follows:
100 - 93 = A; 92.9 - 89 = A- ; 88.9- 86 = B+; 85.9 - 80= B; 79.9- 76 = B- ; 75.9-73 = C+ ; 72.9 - 67 = C ; 66.9 - 64 = C-; 63.9-60= D; 59.9- 0 = F

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DATE	TOPICS	
Aug. 20	Special Relativity-Basics Ideas-Part 1	
Aug. 23	Special Relativity- Einstein Postulates - simultaneity	
Aug. 27	Einstein Postulates-time dilation	
Aug.30	Lorentz Transformation Equations	
Sept.3	Relativistic Energy	
Sept.6	Doppler effect	
Sept.10	Wave and Particles I	
Sept.13	**Exam 1**	
Sept.17	Black Body Radiation: A new fundamental Constant	
Sept.20	Photoelectric Effect	
Sept.24	The Production of X-Rays	
Sept.27	The Compton Effect-pair production	
Oct.1	Is the wave a particle	
Oct.4	Wave and Particles II: Properties of matter waves	
Oct.8	Matter wave interference: Evidence The Bragg Law	
Oct.15	Properties of Matter Waves	
Oct.18	The Free-Particle Schrodinger equation	Wave on a String Electromagnetic waves- Matter waves- The plane wave
Oct.25	**Exam 2**	
Oct.29	The Uncertainty Principle	
Nov.1	The Bohr Model of the Atom	
Nov.5	Bonding: Molecules and Solids- When atoms come together-Molecules Bonding	
Nov.8	Rotation and Vibration	
Nov.12	Crystalline Solids-Energy Bands	
Nov.15	Conductors, Insulators and Semiconductors	
Nov.19	Semiconductor Devices-Fullerenes Nuclear Physics: Basic Structure-Binding- Nuclear Models	
Nov.22	**Exam 3**	

Nov.26	**Class evaluations -**Radioactivity Radioactive Decay -Radioactive Decay 2	
11-27W-11-29F	**Thanksgiving Break – no classes**	
Dec 5	**Final exam (Paper due on Dec. 5 by 5:00pm)**	