Embry-Riddle Aeronautical University
Prescott Campus

Course	**PS303.01**	**Modern Physics (Spring 2019)**	**3 credit hours**

Last Updated: Jan. 8, 2019

Time	T Th 9:10 – 10:25 am	Room 55B

Instructor **Dr. Darrel Smith**
Office Hours are posted on my web site: http://physicsx.pr.erau.edu/
Office AC1-253

Course Description
This is an introductory course in modern physics and introduces students to concepts in relativity and quantum mechanics. Topics discussed in this course include sources of electromagnetic radiation, special relativity, wave-particle duality, the uncertainty principle and quantum theory of atomic structure, x-rays, lasers and nuclear reactions.
Prerequisite: PS219

Goals
The main goals of this course are to introduce the student to the two major concepts of Modern Physics—quantum theory and relativity theory. This course will introduce students to non-classical microscopic phenomena, introduce the abstract ideas and terminology used in their description and prepare the student for more rigorous studies of Quantum Physics. The students are expected to understand the contradictions between predictions based on the principles of classical physics and various observations indicative of quantum phenomena (such as blackbody radiation, photoelectric effect, Compton scattering, electron diffraction, atomic line spectra, etc.). The need for and quantitative applications of modern concepts to explain these phenomena are also emphasized.

Learning Outcomes
1. Define the physical constraints on a wave function and its derivatives, the probability of finding a particle in a given region of space from a known wave function, wave packets and photons, the momentum operator, the energy operator, the Hamiltonian, the normal Zeeman effect, the anomalous Zeeman effect, Larmor precession, proper time, proper length, nuclear fission and fusion, Einstein's postulates of the special theory of relativity.

2. Demonstrate knowledge through discussion of the view physicists held for light before 1800, shortly after 1800 and shortly after 1900, Young's two slit experiment and its physical implications, interference effects from and engineering applications of thin films, the failure of the Galilean transformations, the events leading to Einstein's two postulates, the photoelectric effect and its engineering applications, Compton scattering, the differences in radiation given off from solids, liquids and gases, experimental observations that led to the deBroglie hypothesis and the wave-particle duality of light and matter, the Heisenberg Uncertainty Principle, the one-dimensional square barrier and its application to tunneling, the scanning tunneling microscope, the sodium doublet, the introduction of spin and the Pauli Exclusion Principle.

3. Solve problems regarding intensity patterns for a simple slit, thin film application, special theory of relativity, relativistic momentum and kinetic energy, the total relativistic energy,

wavelengths of material bodies, expectation values, the Schrodinger equation in one dimension and three dimensions, the Schrodinger equation as applied to a particle in a box, the simple harmonic oscillator, for a free particle, and the normalization of wave functions.

4. Use orbital and spin angular momentum and their magnetic moments, the total angular momentum to study interactions among electrons of the same atom as well as with external electric and magnetic fields.

5. Draw energy level diagrams for atomic absorption and emission lines utilizing selection rules.

6. Calculate energy level diagrams for a particle in a potential well, a simple harmonic oscillator, and hydrogen-like systems.

7. Demonstrate very basic understanding of elementary nuclear physics, lasers, superconductivity, electron spin, and nuclear magnetic resonance.

Textbook **"Modern Physics, 3rd edition"**
by Kenneth Krane John Wiley & Sons © 2012
ISBN: 9781118061145

Attendance "Regular attendance and punctuality, in accordance with the published class schedule, are expected at all times in all courses." . . . . **Don't miss class !!**

Homework I will post homework assignments on my website along with the due dates—at which time you will turn in your written solutions. Please make sure that your solutions are submitted in the order the problems were assigned. If you make a good faith effort on all the problems in the assignment, you will earn 5 points. I will pick out one or two problems at random and grade them in more detail to see if you have a compelling solution. If you do, you will earn an additional 5 points for a maximum of 10 points for the assignment.

Course Outline

	Chapter 1	The Failures of Classical Physics
	Chapter 2	The Special Theory of Relativity
1st Exam		
	Chapter 3	The Particle-like properties of Electromagnetic Radiation
	Chapter 4	The Wavelike properties of Particles
	Chapter 5	The Schrodinger Equation
2nd Exam		
	Chapter 6	The Rutherford-Bohr Model of the Atom
	Chapter 7	The Hydrogen Atom in Wave Mechanics
	Chapter 8	Many-Electron Atoms
3rd Exam		
	Chapter 12	Nuclear Structure and Radioactivity

Final Exam ***Tuesday April 30, 2019*** ***8:00—10:00 am***

Grading	**Weight**
Homework	20%
Exams	10% + 15% + 15% = 40%
Quizzes	15%
Final Exam	25%

Grading Scale:	
	A 90-100%
	B 80-89%
	C 70-79%
	D 60-69%

Tutoring

Tutoring will begin Tuesday January 16, 2018 with additional times and tutors added throughout the following weeks. Go to**:**

ERNIE → Services → Academics → Tutoring Schedule

Tutoring is free and unlimited for all ERAU students. Always check the online schedule for updates and changes.

Access To Learning

ERAU is committed to the success of all students. It is University policy to provide reasonable accommodations to students with disabilities who qualify for services. If you would like to discuss and/or request accommodations, please contact Disability Support Services in Hazy Library Room 109, extension 6750, or (928) 777-6750.

Civil Rights Equity and Title IX:

ERAU seeks to provide an environment that is free of bias, discrimination, and harassment. If you have been the victim of harassment, discrimination or sexual misconduct, we encourage you to report this. If you inform me of an issue of harassment, discrimination, or sexual misconduct I will keep the information as private as I can, but I am required to bring it to the attention of the institution's Title IX Coordinator. If you would like to talk to the Title IX Coordinator (Liz Higgins Frost) directly, she can be reached at Building 49, Dean of Students Office, 928-777-3747, froste@erau.edu. For more information, please refer to the Nondiscrimination/Title IX webpage at http://prescott.erau.edu/about/health/sexual-misconduct-and-title-ix/index.html.