University of Arkansas – Fort Smith
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General Syllabus

PHYS 29363 University Physics III

Credit Hours: 3 Lecture Hours: 3 Laboratory Hours: 0

Prerequisite: PHYS 20403 University Physics II

Effective: 2018~2019

I. Course Information

A. Catalog Description

An introduction to relativity and relativistic mechanics; quantum theory with applications to atomic and molecular physics; condensed matter physics; nuclear and particle physics.

B. Additional Information

This course is an introduction to more advanced topics in physics.

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Summarize the concept of classical relativity and relative velocities.
2. Define inertial and non-inertial reference frames.
3. Explain the reasoning behind the ether hypothesis.
4. Explain the general concept and operation of the Michelson-Morley experiment.
5. Explain its result.
6. Explain the effect on the ether concept.
7. Explain how the two postulates of relativity imply the relativity of simultaneity.
8. Explain how the relativity of simultaneity leads to length contraction.
9. Understand the concepts of time dilation and length contraction.
10. Calculate the relationship between time intervals and lengths observed in different inertial frames.
11. Understand the relativistically correct expressions for kinetic energy, momentum, and total energy when objects move near the speed of light.
12. Understand the equivalence of mass and energy.
13. Use the relativistically correct expressions to calculate energy and momentum in particle interactions.
14. Explain the principle of equivalence.

15. Specify some of the predictions of general relativity.
16. Understand the necessity for a relativistic velocity addition equation.
17. Apply it to simple relative velocity calculations.
18. Define blackbody radiation and use Wien's law.
19. Explain how Planck's hypothesis paved the way for quantum ideas.
20. Describe the photoelectric effect.
21. Explain how it can be understood by assuming that light energy is carried by particles.
22. Summarize the properties of photons.
23. Describe how the photon model of light explains scattering of light from electrons (the Compton effect)
24. Calculate the wavelength of the scattered light in the Compton effect.
25. Discuss some of the practical applications of the quantum hypothesis – in particular, the laser.
26. Explain de Broglie's hypothesis.
27. Calculate the "wavelength" of a matter wave.
28. Specify under what circumstances the wave nature of matter will be observable.
29. Explain the reasoning that underlies the Schrodinger wave equation.
30. Understand this equation's use in finding particle wave functions.
31. Discuss the structure of the periodic table in terms of quantum mechanical electron orbits and the Pauli Exclusion Principle.
32. Understand the inherent quantum mechanical limits on the accuracy of physical observations.
33. Understand the relationship between particles and antiparticles.
34. Understand the energy requirements for pair production.

B. University Learning Outcomes
This course enhances student abilities in the following areas:

Analytical Skills
Critical Thinking Skills: Students will identify a problem or issue and will research, evaluate, and compare information from varying sources in order to evaluate authority, accuracy, recency, and bias relevant to the problems/issues. The student will generate solutions/analysis of problems/issues evaluated and will assess and justify the solutions and/or analysis.

Communication Skills (written and oral)
Students will communicate proficiently. The student will compose coherent documents appropriate to the intended audience and effectively communicate orally in a public setting.

Ethical Decision Making
Students will model ethical decision-making processes. The students will identify ethical dilemmas and affected parties and will apply ethical frameworks to resolve a variety of ethical dilemmas.

Global & Cultural Perspectives
Students will reflect upon cultural differences and their implications for interacting with people from cultures other than their own. The students will demonstrate understanding or application of their discipline in a global environment and will demonstrate how their discipline impacts or is impacted by different cultures.

III. Major Course Topics

A. Wave particle Duality
B. Quantum Physics
C. Schrodinger Equation
D. Atoms
E. Molecules
F. Solids
G. Relativity
H. Nuclear Physics
I. Elementary Particles
J. Beginning of the Universe