PHYS 43 Course Outline as of Fall 2006

CATALOG INFORMATION

Dept and Nbr: PHYS 43 Title: MODERN PHYSICS
Full Title: Modern Physics for Scientists and Engineers
Last Reviewed: 1/23/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	2.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	2.00	Lab Scheduled	0	17.5	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	2.00		Contact Total	35.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 105.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	PHYS 4D

Catalog Description:
This is a course intended for scientists and engineers and will include special relativity, atomic structure and quantum physics, nuclear processes, high energy physics.

Prerequisites/Corequisites:
Completion of PHYS 41 or higher (V5) and Course Completion or Current Enrollment in PHYS 42 (or PHYS 4C) and Course Completion or Current Enrollment in MATH 2 (or MATH 2B)

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: This course is intended for scientists and engineers and will include special relativity, atomic structure and quantum physics, nuclear processes, high energy physics. (Grade Only)
Prerequisites/Corequisites: Completion of PHYS 41 or higher (V5) and Course Completion or Current Enrollment in PHYS 42 (or PHYS 4C) and Course Completion or Current Enrollment in MATH 2 (or MATH 2B)

Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC. (CAN PHYS 43+PHYS 4A+PHYS 42+PHYS 41=PHYS SEQ C)
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**			Effective:	Inactive:
CSU GE:	**Transfer Area**			Effective:	Inactive:
	B1	Physical Science		Spring 1984	
IGETC:	**Transfer Area**			Effective:	Inactive:
CSU Transfer:	Transferable	Effective:	Spring 1984	Inactive:	
UC Transfer:	Transferable	Effective:	Spring 1984	Inactive:	

CID:
CID Descriptor: PHYS 200S Calculus-Based Physics for Scientists and Engineers: ABC
SRJC Equivalent Course(s): PHYS40 AND PHYS41 AND PHYS42 AND PHYS43

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Outcomes and Objectives:
Upon completion of the course, the student should be able to:
1. State the Einstein postulates of special relativity, and discuss the concepts of and solve problems involving the transformation of co-ordinates in space and time, length contraction, time dilation, relativistic momentum and energy, and the relativistic addition of velocities.
2. Trace the development of quantum physics from Planck's work with black body radiation to Einstein's explanation of the photoelectric effect, to Compton scattering, and solve problems involving the photoelectric effect and Compton scattering.
3. State the postulates made by Bohr in developing the Bohr model of the atom; reproduce the derivation of allowed radii and energy levels in the Bohr model; solve problems involving electron energy levels and spectral lines; describe the shell and subshell structure of orbital electrons relating this structure to the periodic table.
4. Describe what is meant by wave-particle duality; solve problems involving particles as waves; solve problems using the uncertainty principle.
5. Write the one-dimensional nonrelativistic Schroedinger wave equation; solve problems involving wave functions for the infinite square well, one-dimensional harmonic oscillator, and hydrogen atom including finding probabilities of finding a particle in a region of space and expectation values of physically measurable quantities.
6. Define terms used in describing atomic nuclei; calculate nuclear binding energies; write equations for radioactive decay processes;

solve problems involving half-lives; and calculate Q values for radioactive decays.
7. Explain the concept of cross-section in nuclear interactions; solve problems involving cross-sections; write equations for nuclear interactions; and calculate threshold energies and Q values.
8. Sketch and describe the significance of the curve of binding energy per nucleon versus mass number; write equations for nuclear fusion and nuclear fission processes; calculate Q values for nuclear fusions and fissions; describe the components of and processes occurring in nuclear reactors.
9. Indicate the properties of quarks, leptons, mesons and baryons and the conservation laws which apply in their interactions; and list the fundamental forces in nature and the field particles for and types of particles involved in each of these interactions.

Topics and Scope:

1. Special Relativity.
   a. transformation of space and time coordinates
   b. length contraction and time dilation
   c. relativistic momentum and energy
   d. relativistic addition of velocities
2. Early Quantum Physics.
   a. black body radiation and Max Planck
   b. the photoelectric effect and the photon
   c. Compton scattering
3. The Bohr Model of the Atom.
   a. quantization of angular momentum
   b. energy levels and spectra
   c. the periodic table and electron shells and subshells
4. Early Wave Mechanics.
   a. DeBroglie hypothesis and electron diffraction
   b. Heisenberg uncertainty principle
   c. wave-particle duality
5. The Schroedinger Wave Equation.
   a. solution of infinite square well potential & hydrogen atom.
   b. probability and expectation values (square well, quantum oscillator, hydrogen atom)
6. Nuclear Processes
   a. nuclear structure, binding energy
   b. radioactive decay - half life, decay modes, Q values
   c. nuclear interactions - cross-sections, Q values
   d. fission - nuclear reactors, fission products, Q values
   e. fusion - fusion reactors, Q values
7. Elementary Particles
   a. accelerators and detectors
   b. the Standard Model - leptons, quarks, mesons and baryons
8. Other topics as time allows (solid state intro., lasers, superconductivity, etc.)

Assignment:

1. No less than eight sets of homework problems.
2. Five to fifteen quizzes.
3. No less than two mid-term exams.
4. Final exam.

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems	Problem solving 15 - 25%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Multiple choice, Problems to solve and exams.	Exams 75 - 85%

Other: Includes any assessment tools that do not logically fit into the above categories.

None	Other Category 0 - 0%

Representative Textbooks and Materials:
Modern Physics for Scientists and Engineers, Thornton & Rex, 2nd edition, Saunders, 2000