PHYS R102: COLLEGE PHYSICS 2

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
PHYS - Physics

Course Number (CB01B)
R102

Course Title (CB02)
College Physics 2

Banner/Short Title
College Physics 2

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This course is an introduction to electromagnetic theory, optics, and modern physics that is appropriate for non-majors. It assumes a prior knowledge of mathematics through algebra/trigonometry, and of the fundamentals of classical mechanics. Central topics include electricity, magnetism, optics, quantum ideas, atomic and nuclear physics, and special relativity. The course is designed to meet the needs of students majoring in the biological sciences and science-allied fields such as architecture.

Taxonomy of Programs (TOP) Code (CB03)
1902.00 - Physics, General

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
70
Maximum Contact/In-Class Lecture Hours
70

Activity

Laboratory

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
70
Total Maximum Contact/In-Class Hours
70

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
140
Maximum Outside-of-Class Hours
140

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
210
Total Maximum Student Learning Hours
210

Minimum Units (CB07)
4
Maximum Units (CB06)
4

Prerequisites
PHYS R101

Entrance Skills

Entrance Skills
Students are expected to have knowledge depicting and solving physical systems by use of diagrams, proper mathematics, and the laws of physics.

Prerequisite Course Objectives
PHYS R101-Draw a diagram or cartoon that clearly and usefully depicts the salient features and characteristics of a mechanical or thermodynamic system, and is labeled or annotated so that known and unknown quantities can readily be determined by examination of the diagram and other written information that accompanies it.
PHYS R101-Analyze a simple mechanical or thermodynamic system to identify applicable principles (e.g., conservation laws) that may be used to predict the future behavior or evolution of the system.
PHYS R101-Solve conceptual and numerical problems related to the behavior or evolution of a mechanical or thermodynamic system by applying those principles identified above.
PHYS R101-Employ appropriate mathematical tools to solve a variety of equations encountered in the study of physics, including geometric/graphical approaches, approximation techniques, and/or numerical methods.
PHYS R101-Argue for or against a scientific hypothesis, supporting their conclusions by describing how various physical principles might apply to a novel situation.

Requisite Justification

Requisite Type
Prerequisite

Requisite
PHYS R101

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Student will be able to calculate the angular dispersion of white light passing through a triangular prism.
2	Student will be able to determine the focal length of thin lens given a plot of image distance versus object distance.
3	Students will be able to determine the resultant "Electric Field" at a location in the proximity of a distribution of point charges.
4	Students will be able to properly construct a ray diagram and use the information contained to determine the physical properties of the image produced by a lens.
5	The student will be able to apply appropriate quantitative and qualitative methods to interpret and analyze pertinent data.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Draw a diagram or cartoon that clearly and usefully depicts the salient features and characteristics of an electromagnetic, optical, or relativistic (mechanical) system, and is labeled or annotated so that known and unknown quantities can readily be determined by examination of the diagram and other written information that accompanies it.
2	Analyze a simple electromagnetic, optical, or relativistic (mechanical) system to identify applicable principles (e.g., Kirchhoff's laws, lens equations, conservation laws, Einstein's principle of relativity) that may be used to predict the behavior or evolution of the system.
3	Solve conceptual and numerical problems related to the behavior or evolution of an electromagnetic, optical, or relativistic (mechanical) system by applying those principles identified above.
4	Employ appropriate mathematical tools to solve a variety of equations encountered in the study of physics, including geometric/graphical approaches, approximation techniques, and/or numerical methods.
5	Argue for or against a scientific hypothesis, supporting one's conclusions by describing how various physical principles might apply to a novel situation.
6	Identify the names and major contributions of notable historical and present-day physicists whose work has expanded humankind's understanding of electromagnetic, optical, and relativistic systems.

Course Content

Lecture/Course Content

1. Electric forces and fields
   a. Properties and types of electrically charged particles
   b. Insulators and conductors
   c. Coulomb's law for point charges
   d. The electric field and field lines
   e. Conditions for electrostatic equilibrium
   f. Millikan oil drop experiment (determination of the elementary quantum of charge e)
2. Electrical energy and capacitance
   a. Electric potential and potential difference
      i. Point charges
      ii. Charged conductors
      iii. Equipotential surfaces
      iv. Potential energy
   b. Capacitance
      i. Definition
      ii. Parallel-plate capacitor
      iii. Combinations of capacitors
      iv. Energy stored in a charged capacitor
3. Current and resistance
   a. Electric current
   b. Drift speed of particles composing a current
   c. Resistance

        i. Ohm's law
        ii. Resistivity
        iii. Temperature variation of resistance
    d. Electrical energy and power
4. Direct current (DC) circuits
    a. Sources of electromotive force (EMF)
    b. Combinations of resistors
    c. Kirchhoff's rules and complex DC circuits
    d. Resistor-capacitor (RC) circuits
    e. Household circuits and electrical safety
5. Magnetism
    a. Magnets and magnetic fields
    b. The geomagnetic field
    c. Magnetic force on a current-carrying conductor
    d. Magnetic torque on a current-carrying loop
    e. Motion of a charged particle in a magnetic field
    f. Ampère's law
6. Induced voltages and inductance
    a. Magnetic flux
    b. Faraday's law of induction and induced EMF
    c. Motional EMF
    d. Lenz's law
    e. Electric generators
    f. Self-inductance
    g. Resistor-inductor (RL) circuits
7. Alternating current (AC) circuits
    a. Individual circuit element behavior in AC circuits
        i. Resistors
        ii. Inductors
        iii. Capacitors
    b. Combination (RLC) series circuits
    c. Power and resonance in AC (RLC) series circuits
    d. The transformer
8. Electromagnetic (EM) waves
    a. Maxwell's equations (qualitative)
    b. Hertz's discoveries
    c. Production and detection of EM waves by an antenna
    d. Properties and spectrum of EM waves
    e. Doppler effect for EM waves
    f. The nature and speed of light
9. Geometric optics
    a. Reflection and refraction of light
    b. The ray approximation
    c. Laws of reflection and refraction
    d. Dispersion, prisms, and rainbows
    e. Huygens's principle
    f. Total internal reflection
    g. Mirrors
    h. Lenses
10. Wave optics
    a. Interference of light
    b. Young's double-slit experiment
    c. Phase inversion upon reflection
    d. Thin-film interference
    e. Diffraction

i. Multiple-slit diffraction
ii. Single-slit diffraction
iii. Resolution of single-slit and circular apertures
f. Polarization

11. Special relativity
a. Galilean relativity
b. Einstein's principle of relativity
i. Speed of light
ii. Michelson-Morley experiment
iii. Consequences of special relativity

12. Quantum physics
a. Blackbody radiation and Planck's photon hypothesis
b. Photoelectric effect and its applications
c. X-rays and the Compton effect
d. Pair production and annihilation
e. Wave-particle duality
i. Photons and electromagnetic waves
ii. The wave properties of particles and the quantum wave function
f. Heisenberg uncertainty principle
g. The scanning tunneling microscope and the atomic force microscope

13. Atomic physics
a. Early models of the atom
b. Atomic spectra
c. The hydrogen atom
i. Bohr theory
ii. DeBroglie waves
iii. Modern quantum description
d. The spin magnetic quantum number
e. Electron clouds
f. Pauli exclusion principle and the periodic table of the elements
g. Atomic transitions

Laboratory or Activity Content

None

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Essays
Objective exams
Problem-Solving Assignments
Problem-solving exams
Quizzes

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Computer-aided presentations
Distance Education
Instructor-guided interpretation and analysis
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

1. Computer aided presentation: The instructor may employ the computer to aid in the presentation of course materials which would include simulations of specific phenomena such as electric field contours due to specific charge distributions.
2. Demonstrations: The instructor will demonstrate physical principles by employing equipment and other items such as a Van de Graaff and Whilmhurst machine to show the effects of a collection of charge.
3. Distance Education: When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meetings will be used to allow students to ask questions regarding the course and its material.
4. Instructor guided analysis: The instructor will work through physics problems during lecture that investigate a given system in which the students will follow along, answering questions posed by the instructor. This will also serve as a forum for students to ask particular questions regarding the logic and methods employed to come to certain conclusions.
5. Lecture: The instructor will deliver the course subject matter via in-person lectures to the students. For example, a lecture on Kirchhoff's Laws.
6. Small group activities: These may be employed in the form of group quizzes where students work together in small groups to solve some physics problems regarding current material.

Representative Course Assignments

Writing Assignments

1. The homework includes conceptual questions, generally related to the physical principles discussed in the course, that require short-essay style responses to explain an issue or to justify or refute phenomena; for example, a question may ask a student about the relationship between the photoelectric effect and the operation of the light sensor in a camera.

Critical Thinking Assignments

1. Answering a wide array of homework, quiz, and exam questions requiring the analysis of a given physical system or circumstance in order to come to the correct conclusion and/or answer regarding the question and/or desired outcome. For instance, given 5 resistors of 1000 Ohms each and a capacitor of 470 micro Farads, what configuration of the resistors would produce an RC time constant nearest 1.00 seconds and what is the actual time constant of the configuration?

Reading Assignments

1. Regular textbook readings that reinforce the concepts discussed or demonstrated during the class meetings; these readings generally include theory and principles, descriptions of the results of important experiments, data tables, definitions, problem-solving examples, and practical applications of physics in everyday life and in specialized environments.
2. Library and other research needed to complete homework problems and/or prepare talks or reports.

Skills Demonstrations

None

Other assignments (if applicable)

None

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook accounting for 2 hours per week.
2. Assigned conceptual and problem solving based homework that further investigates and explores the notions and theories discussed throughout the course. This will generally require 6 hours per week.
3. Studying and preparing for quizzes and exams.

Articulation

C-ID Descriptor Number

PHYS 110

Status

Approved

Additional C-ID Descriptor(s)

C-ID Descriptor(s)	Status
PHYS 100S (PHYS R101/L + PHYS R102/L)	Approved

Comparable Courses within the VCCCD
PHYS M10B - General Physics II
PHYS V02B - General Physics II: Algebra/Trigonometry-Based

District General Education

A. Natural Sciences

A2. Physical Science
Approved

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Fall 1999

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

B1 Physical Science
Approved

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Approved

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 5A: Physical Science
Approved

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Serway, R. A. & Vuille, C. (2018). *College Physics* (11th). Boston, Cengage Learning.

Resource Type
Other Resource Type

Description
Supplemental handouts on selected topics prepared by the instructor..

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.
Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.

Examinations

Hybrid (1%–50% online) Modality

Online
On campus

Hybrid (51%–99% online) Modality

Online
On campus

Primary Minimum Qualification

PHYSICS/ASTRONOMY

Review and Approval Dates

Department Chair
09/02/2020

Dean
09/02/2020

Technical Review
09/23/2020

Curriculum Committee
09/23/2020

DTRW-I
MM/DD/YYYY

Curriculum Committee
11/25/2020

Board
MM/DD/YYYY

CCCCO
MM/DD/YYYY

Control Number
CCC000591916

DOE/accreditation approval date
MM/DD/YYYY