Cerro Coso College

Course Outline of Record Report

10/07/2021

PHYSC211 : Waves, Optics, and Modern Physics

General Information

Author:	-
Course Code (CB01) :	PHYSC211
Course Title (CB02) :	Waves, Optics, and Modern Physics
Department:	Science
Proposal Start:	Fall 2013
TOP Code (CB03) :	(1902.00) Physics, General
SAM Code (CB09) :	Non-occupational
Distance Education Approved:	Yes
Course Control Number (CB00) :	CCC000331426
Curriculum Committee Approval Date:	02/07/2014
Board of Trustees Approval Date:	03/06/2014
External Review Approval Date:	07/16/2014
Course Description:	This course covers the laws governing wave motion, thermodynamics, optics, atomic physics, quantum physics, and other aspects of modern physics.
Submission Type:	New Course
Author:	No value

Faculty Minimum Qualifications

Master Discipline Preferred:	• Physics/Astronomy
Alternate Master Discipline Preferred:	• Physics/Astronomy
Bachelors or Associates Discipline Preferred:	No value
Additional Bachelors or Associates Discipline Preferred:	No value

Course Development Options

Basic Skills Status (CB08)

Course is not a basic skills course.

Course Special Class Status (CB13)

Course is not a special class.

Grade Options

- Letter Grade Methods
- Pass/No Pass

☐ Allow Students to Gain Credit by Exam/Challenge

Allowed Number of Retakes

0

Course Prior To College Level (CB21)

Not applicable.

Rationale For Credit By Exam/Challenge

Retake Policy Description

☑ Allow Students To Audit Course

No value

Type:|Non-Repeatable Credit

Course Support Course Status (CB26)

No value

Associated Programs

☑ Course is part of a program (CB24)

Associated Program	Award Type	Active
CC General Sciences	A.A. Degree Major	Spring 2018
CC Liberal Arts: Mathematics & Science	A.A. Degree Major	Summer 2018 to Fall 2020
CSU General Education (CSU GE Breadth)	Certificate of Achievement	Fall 2020
Intersegmental General Education Transfer Curriculum Certificate of Achievement	Certificate of Achievement	Fall 2020
Liberal Arts: Mathematics & Science Associate in Arts Degree	A.A. Degree Major	Fall 2020
CSU General Education (CSU GE Breadth) (In Development)	Certificate of Achievement	Fall 2021
Intersegmental General Education Transfer Curriculum Certificate of Achievement (In Development)	Certificate of Achievement	Fall 2021

Transferability & Gen. Ed. Options

Course General Education Status (CB25)

No value

Transferability

Transferable to both UC and CSU

Transferability Status

Approved

Cerro Coso General Education Requirements	Categories	Status	Approval Date	Comparable Course

Area 1.2	Natural Science Physical Sciences	Approved	No value	No Comparable Course defined.

CSU General Education Certification	Categories	Status	Approval Date	Comparable Course
Area B.1	Scientific Inquiry & Quantitative Reasoning Physical Sciences	Approved	No value	No Comparable Course defined.

Intersegmental General Education Transfer Curriculum	Categories	Status	Approval Date	Comparable Course
Area 5.A	Physical & Biological Sciences Physical Science	Approved	No value	No Comparable Course defined.

Units and Hours:

Summary

Minimum Credit Units (CB07)	5
Maximum Credit Units (CB06)	5
Total Course In-Class (Contact) Hours	144
Total Course Out-of-Class Hours	126
Total Student Learning Hours	270
Faculty Load	0

Credit / Non-Credit Options

Course Credit Status (CB04)

Credit - Degree Applicable

Course Non Credit Category (CB22)

Credit Course.

Non-Credit Characteristic

No Value

Course Classification Status (CB11)

Credit Course.

Funding Agency Category (CB23)

Not Applicable.

☐ Cooperative Work Experience Education Status (CB10)

☐ Variable Credit Course

Weekly Student Hours

	In Class	Out of Classs
Lecture Hours	3.5	7
Laboratory Hours	4.5	0
Activity Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	0
Course In-Class (Contact) Hours	
Lecture	0

Laboratory	0
Activity	0
Total	144

Course Out-of-Class Hours

Lecture	0
Laboratory	0
Activity	0
Total	126

Time Commitment Notes for Students

No value

Faculty Load

Extra Duties: 0

Faculty Load: 0

Units and Hours: - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

Pre-requisites, Co-requisites, Anti-requisites and Advisories

Prerequisite

PHYSC113 - Electricity and Magnetism

PHYS C111, PHYS C113, and PHYS C211 are a sequence of three physics courses, where the skills learned in each preceding course are utilized in the course that follows it. Therefore, the skills learned in PHYS C113 are required for PHYS C211.

Entrance Skills

Entrance Skills	Description
No value	No value

Limitations on Enrollment

Limitations on Enrollment	Description
No value	No value

Specifications

Methods of Instruction

Methods of Instruction	Other
Rationale	Other Methods: Recitation
Methods of Instruction	Problem Solving
Rationale	No value
Methods of Instruction	Written work
Rationale	No value
Methods of Instruction	Group Work
Rationale	No value
Methods of Instruction	In-class writing
Rationale	No value
Methods of Instruction	Instruction through examination or quizzing
Rationale	No value
Methods of Instruction	Laboratory
Rationale	No value
Methods of Instruction	Lecture
Rationale	No value

Methods of Instruction	Outside reading
Rationale	No value

Methods of Instruction	Discussion
Rationale	No value

Methods of Instruction	Demonstration
Rationale	No value

Methods of Instruction	Computational Work
Rationale	No value

Assignments

A. Regular homework assignments to reinforce material covered in class. Example: The student is expected to answer instructor assigned questions from the relevant textbook chapters. B. Readings from the assigned textbook chapters. Example: The student is expected to read the textbook chapter that is covered each week. C. Preparatory readings for the assigned laboratory experiments. Example: The student is expected to read the lab procedures before each week's lab experiment. D. Written laboratory reports. Example: The student is expected to summarize his/her lab data, analysis, and results in the form of a written lab report.

Methods of Evaluation	Rationale
Homework	A. Regular homework assignments to reinforce material covered in class. Example: The student is expected to answer instructor assigned questions from the relevant textbook chapters.
Tests	B. Quizzes and exams evaluate the student's ability to apply techniques taught in class and apply these techniques to solving problems. Example: A question on the first exam or quiz would include a question that requires the use of the wave equation.
Participation	C. Laboratory experiments measure the student's ability to perform experiments, work in groups, and assess the accuracy and precision of experiments where appropriate. Example: A laboratory experiment involving the analysis of the Doppler Effect. D. Written laboratory reports. Example: The student is expected to summarize his/her lab data, analysis, and results in the form of a written lab report.

Equipment

No Value

Textbooks

Author	Title	Publisher	Date	ISBN

Halliday, Resnick, and Walker. (2014) Fundamentals of Physics, Extended, 10th, John Wiley & Sons, Inc.

Other Instructional Materials

Description	Other: Laboratory notes and procedures are developed locally by the local physics instructors.
Author	
Citation	Waves, Optics, and Modern Physics

Materials Fee

No

Learning Outcomes and Objectives

Course Objectives

No value

CSLOs

Analyze basic physical situations involving reflection and refraction, and use this analysis to predict the path of a light ray.

Expected SLO Performance: 70.0

Science Liberal Arts: Mathematics & Science AA Degree	Describe the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world.

Analyze situations involving interference and diffraction of light waves, and apply these to situations including double slits, diffraction gratings, and wide slits.

Expected SLO Performance: 70.0

Apply concepts from special relativity to analyze physical situations, including time dilation, length contraction, and relativistic momentum and energy.

Expected SLO Performance: 70.0

Apply basic concepts of quantum mechanics to analyze basic physical setups, including a particle in a box and simple atomic models.

Expected SLO Performance: 70.0

Social Science IGETC PLOs	Communicate scientific results by applying the appropriate scientific method, including experimental and empirical methodologies characteristic of science and modern methods and tools used in scientific inquiry through the use of graphs, oral communications, and writings.
Science Liberal Arts: Mathematics & Science AA Degree	Apply algebraic, graphical, numerical, and other methods to solve applied problems in the areas of mathematics, natural sciences, computer graphics, and computer animation.
Social Science PLOs for CSU GE COA	Communicate scientific results by applying the appropriate scientific method, including experimental and empirical methodologies characteristic of science and modern methods and tools used in scientific inquiry through the use of graphs, oral communications, and writings.

Analyze experimental data, including appropriate use of units and significant figures.

Expected SLO Performance: 70.0

Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class. Expected SLO Performance: 70.0

Outline

Course Outline

A. Oscillations
1. Simple Harmonic Motion
2. Energy in Simple Harmonic Motion
3. Pendulums
4. Damped Simple Harmonic Motion
5. Forced Oscillations and Resonance

B. Waves
1. Transverse and Longitudinal Waves
2. Wavelength; Frequency; and Speed
3. The Wave Equation
4. The Principle of Superposition for Waves
5. Interference of Waves
6. Phasors
7. Standing Waves and Resonance

C. Sound Waves
1. Sound Waves
2. The Speed of Sound
3. Traveling Sound Waves
4. Interference and Intensity
5. The Doppler Effect
6. Supersonic Speeds and Shock Waves

D. Thermodynamics
1. The Zeroth Law of Thermodynamics
2. Temperature; Heat; and Heat Transfer
3. The Absorption of Heat by Solids and Liquids
4. Thermal Expansion
5. Heat and Work
6. The First Law of Thermodynamics
7. Entropy
8. The Second Law of Thermodynamics
9. Heat Engines
10. A Statistical View of Entropy

E. The Kinetic Theory of Gases
1. Ideal Gases
2. Pressure; Temperature; RMS Speed; and the Mean Free Path
3. Translational Kinetic Energy
4. The Distribution of Molecular Speeds
5. The Molar Specific Heats of an Ideal Gas
6. The Adiabatic Expansion of an Ideal Gas

F. Electromagnetic Waves
1. The Traveling Electromagnetic Wave
2. Energy Transport and the Poynting Vector
3. Radiation Pressure
4. Polarization
5. Reflection and Refraction
6. Total Internal Reflection

G. Images
1. Images
2. Plane Mirrors
3. Spherical Mirrors

4. Images from Spherical Mirrors
5. Spherical Refracting Surfaces
6. Thin Lenses
7. Optical Instruments

H. Interference
1. Light as a Wave
2. Diffraction
3. Young's Interference Experiment
4. Coherence
5. Intensity in Double-Slit Interference
6. Interference from Thin Films
7. Michelson's Interferometer

I. Diffraction
1. Diffraction and the Wave Theory of Light
2. Diffraction by a Single Slit
3. Diffraction by a Circular Aperture
4. Diffraction by a Double Slit
5. Diffraction Gratings
6. Gratings: Dispersion and Resolving Power

J. Special Relativity
1. The Postulates of Special Relativity
2. The Relativity of Simultaneity
3. The Relativity of Time
4. The Relativity of Length
5. The Lorentz Transformation
6. The Relativity of Velocities
7. Doppler Effect for Light
8. Relativistic Momentum
9. Relativistic Energy

K. Quantum Mechanics
1. Photons as Quanta of Light
2. The Photoelectric Effect
3. Photon Momentum
4. Probability Waves
5. Electrons and Matter Waves
6. Schrodinger's Equation
7. Heisenberg's Uncertainty Principle
8. Barrier Tunneling
9. Wave Function of a Trapped Electron
10. Energies Levels of a Trapped Electron
11. The Bohr Model of the Hydrogen Atom
12. Schrodinger's Equation and the Hydrogen Atom

L. Atomic Physics
1. Atomic Properties
2. Electron Spin
3. Angular Momenta and Magnetic Dipole Moments
4. Magnetic Resonance
5. The Pauli Exclusion Principle
6. Multiple Electrons in Rectangular Traps
7. Building the Periodic Table
8. Lasers

M. Solid State Physics
1. The Electrical Properties of Solids
2. Energy Levels in a Crystalline SolidInsulators
3. Metals
4. Semiconductors
5. Doped Semiconductors
6. The p-n Junction
7. The Light-Emitting Diode (LED)
8. The Transistor

N. Nuclear Physics
1. Nuclear Properties
2. Radioactive Decay
3. Alpha and Beta Decay
4. Radioactive Dating
5. Measuring Radiation Dosage
6. Nuclear Models
7. Nuclear Fission
8. Nuclear Reactors
9. Thermonuclear Fusion

O. Particle Physics
1. Particles
2. The Leptons
3. The Hadrons
4. Conservation Laws
5. The Quark Model
6. The Basic Forces and Bosons
7. The Expansion of the Universe
8. The Cosmic Microwave Background
9. Dark Matter
10. The Big Bang

Lab Outline

The lab portion of this course consists of 10-12 hands-on experiments that complement and reinforce topics covered in lecture. Each lab experiment consists of: lab preparation; data collection; data analysis; and the presentation of lab results in the form of a written lab report. Lab topics may include; but are not limited to:
Simple Harmonic Oscillations
Specific Heats
Ideal Gases
OpticsPolarization
Light Interference
Light Refraction
Photoelectric Effect
Planck's Law
Electron charge-to-mass ratio

Delivery Methods and Distance Education

Delivery Method: Please list all that apply -Face to face -Online (purely online no face-to-face contact) -Online with some required face-to-face meetings (“Hybrid”) -Online course with on ground testing -iTV – Interactive video = Face to face course with significant required activities in a distance modality -Other

Face 2 Face

Rigor Statement: Assignments and evaluations should be of the same rigor as those used in the on-ground course. If they are not the same as those noted in the COR on the Methods of Evaluation and out-of-class assignments pages, indicate what the differences are and why they are being used. For instance, if labs, field trips, or site visits are required in the face to face section of this course, how will these requirements be met with the same rigor in the Distance Education section?

No Value

Effective Student-Instructor Contact: Good practice requires both asynchronous and synchronous contact for effective contact. List the methods expected of all instructors teaching the course. -Learning Management System -Discussion Forums -Moodle Message -Other Contact -Chat/Instant Messaging -E-mail -Face-to-face meeting(s) -Newsgroup/Discussion Board -Proctored Exam -Telephone -iTV - Interactive Video -Other (specify)

No Value

Software and Equipment: What additional software or hardware, if any, is required for this course purely because of its delivery mode? How is technical support to be provided?

No Value

Accessibility: Section 508 of the Rehabilitation Act requires access to the Federal government's electronic and information technology. The law covers all types of electronic and information technology in the Federal sector and is not limited to assistive technologies used by people with disabilities. It applies to all Federal agencies when they develop, procure, maintain, or use such technology. Federal agencies must ensure that this technology is accessible to employees and the public to the extent it does not pose an "undue burden". I am using -iTV—Interactive Video only -Learning management system -Publisher course with learning management system interface.

itv
LMS
publisher

Class Size: Good practice is that section size should be no greater in distance ed modes than in regular face-to-face versions of the course. Will the recommended section size be lower than in on-ground sections? If so, explain why.

No Value