Cerro Coso College

Course Outline of Record Report

10/07/2021

PHSC C121 : Astronomy Lecture

General Information

Author:	• Vivian Baker
Course Code (CB01) :	PHSC C121
Course Title (CB02) :	Astronomy Lecture
Department:	Science
Proposal Start:	Spring 2018
TOP Code (CB03) :	(1911.00) Astronomy
SAM Code (CB09) :	Non-Occupational
Distance Education Approved:	Yes
Course Control Number (CB00) :	CCC000339722
Curriculum Committee Approval Date:	03/09/2012
Board of Trustees Approval Date:	05/03/2012
External Review Approval Date:	Pending
Course Description:	This lecture course is a general survey of the physical Universe from the standpoint of modern astronomy. The course first introduces the methods and tools used in astronomy and then applies them to investigate the many scales of physical structure and phenomena in the Universe. Topics include Solar System scale objects, such as planets, moons, asteroids, comets,and meteoroids; stellar scale objects, such as stars, star clusters, and nebulae; galactic scale objects,such as galaxies and galaxy clusters; and finally the entire Universe itself. Not open to students who have completed PHSC C125.
Submission Type:	Mandatory Revision import
Author:	No value

Faculty Minimum Qualifications

Master Discipline Preferred:	• Astronomy • Physics/Astronomy
Alternate Master Discipline Preferred:	No value
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
No value

Retake Policy Description
Non-Repeatable Credit

☑ Allow Students To Audit Course

Course Support Course Status (CB26)
No value

Associated Programs

☑ Course is part of a program (CB24)

Associated Program	Award Type	Active
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

Pending

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)	3
Maximum Credit Units (CB06)	3
Total Course In-Class (Contact) Hours	54
Total Course Out-of-Class Hours	108
Total Student Learning Hours	162
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	6
Laboratory Hours	0	0
Activity Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	54
Course In-Class (Contact) Hours	
Lecture	54

Laboratory	0
Activity	0
Total	54

Course Out-of-Class Hours

Lecture	108
Laboratory	0
Activity	0
Total	108

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

Advisory

MATHC050 - Elementary Algebra

AND

Advisory

ENGLC040 - Improving Basic Writing Skills

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	Demonstration
Rationale	No value
Methods of Instruction	Discussion
Rationale	No value
Methods of Instruction	Instruction through examination or quizzing
Rationale	No value
Methods of Instruction	Lecture
Rationale	No value
Methods of Instruction	Outside reading
Rationale	No value
Methods of Instruction	Peer analysis, critique & feedback
Rationale	No value
Methods of Instruction	Problem Solving
Rationale	No value
Methods of Instruction	Written work

Rationale	No value

Assignments

Homework assignments from the relevant textbook chapters. Example: The student is expected to answer instructor assigned questions from the relevant textbook chapters.
B. Readings from the assigned textbook. Example: The student is expected to read the textbook chapter covered in each week's lecture.
C. Readings and written summaries of popular astronomy articles or news reports. Example: The student is expected to self-select and read an astronomically relevant article or news report and write a one-page summary.

Methods of Evaluation	Rationale
Tests	Exams evaluate the students' ability to apply concepts and material taught in class. Example: One question on the midterm exam requires students to apply their knowledge of planetary properties to predict which locations in the Solar System are the easiest to colonize by humans and explain why.
Homework	Regular homework assignments reinforce concepts and material taught in class. Example: The student is expected to answer instructor assigned questions from the relevant textbook chapters.
Other	Readings and written summaries of popular astronomy articles evaluate the students' ability to apply concepts taught in class and combine them with new concepts they discover on their own.

Equipment

No Value

Textbooks

Author	Title	Publisher	Date	ISBN
Chaisson, E. & McMillan, S.	Astronomy Today , 7th	Pearson	2011	

Other Instructional Materials

Description	Selected articles in current literature and publications.
Author	No value
Citation	No value

Materials Fee

No value

Learning Outcomes and Objectives

Course Objectives

No value

CSLOs

Analyze and reach valid conclusions from the examination of astronomical graphs, diagrams, and images. Expected SLO Performance: 70.0

Explain how spectroscopy can determine the temperature, radial velocity, and composition of an astronomical object. Expected SLO Performance: 70.0

Explain the crucial roles that the forces of gravity and electromagnetism play in astronomy. Expected SLO Performance: 70.0

Organize the Universe's scales of physical structure in order of increasing size. Expected SLO Performance: 70.0

Demonstrate an understanding of recent astronomical discoveries and developments. Expected SLO Performance: 70.0

Evaluate the validity of information on astronomy as presented in the popular media. Expected SLO Performance: 70.0

Analyze and utilize the scientific method in problem solving. 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.
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.
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.

Effectively communicate scientific results graphically and in writing. Expected SLO Performance: 70.0

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.

Outline

Course Outline

1. Introduction
a. What is Astronomy?
b. Physical Scales of the Universe
c. Time Scales of the Universe
d. Tools of Modern Astronomy
e. Scientific Method and Scientific Theory
2. Motions of the Earth and Moon
24.
a. Earth's Orbital Motion
b. Earth's Diurnal Motion
c. Astronomical Timekeeping
d. Seasons
e. The Motion of the Moon
f. Lunar Phases
g. Lunar Eclipses
h. Solar Eclipses

i. The Measurement of Distance
3. Scientific Method and the History of Astronomy
a. Ancient Astronomy
b. Geocentric Universe
c. Heliocentric Model of the Solar System
d. The Birth of Modern Astronomy
e. Kepler's Laws of Planetary Motion
f. The Dimensions of the Solar System
g. Newton's Laws of Universal Motion
h. Newton's Law of Gravity
i. Escape Speed
4. Radiation
a. Waves in General
b. Velocity, Wavelength, and Frequency Relationship
c. Electromagnetism
d. Electromagnetic Waves
e. Electromagnetic Spectrum
f. Temperature and Thermal Radiation
g. Color and Wien's Law
h. Brightness and Stefan's Law
i. Radial Velocity and the Doppler Effect
5. Spectroscopy
a. Atoms
b. Photon Energy
c. The Bohr Model of the Atom
d. Continuous Spectra
e. Emission Line Spectra
f. Absorption Line Spectra
g. Kirchhoff's Laws
h. Analyzing Spectra
6. Telescopes
a. Light Refraction
b. Refracting Telescopes
c. Light Reflection
d. Reflecting Telescopes
e. Telescope Design
f. Telescope Light Gathering Power
g. Telescope Angular Resolution
h. Telescope Magnification
i. Telescope Image Detectors
7. Effects of Earth's Atmosphere on Telescope Images
a. Atmospheric Turbulence
b. Atmospheric Opacity
c. Atmospheric Light Pollution
d. Space-Based Astronomy
e. Full Electromagnetic Spectrum Coverage
8. Introduction to the Solar System
a. Inventory of the Solar System
b. Structure of the Solar System
c. Terrestrial Planet Properties
d. Jovian Planet Properties
e. Interplanetary Debris Properties
f. Comparative Planetology
g. Space Exploration Missions
h. Formation of the Solar System
9. Earth
a. Interior of Earth
b. Internal Heat Sources
c. Cooling Processes
d. Seismology
e. Plate Tectonics
f. Surface Features of Earth
g. Atmosphere of Earth
h. Blue Skies and Red Sunsets
i. Greenhouse Effect
j. Magnetosphere of Earth
k. Auroras

l. The Tides
10. The Moon and Mercury
a. Physical Properties of the Moon and Mercury
b. Interiors of the Moon and Mercury
c. Surface Features of the Moon and Mercury
d. Impact Cratering
e. Orbits and Rotation Rates of the Moon and Mercury
f. Synchronous Orbit
g. The Origin of the Moon
h. Evolutionary History of the Moon and Mercury
11. Venus
a. Physical Properties of Venus
b. Interior of Venus
c. Surface Features of Venus
d. Atmosphere of Venus
e. Orbit and Rotation Rate of Venus
f. Evolutionary History of Venus
g. Observing Venus from Earth
12. Mars
a. Physical Properties of Mars
b. Interior of Mars
c. Surface Features of Mars
d. Atmosphere of Mars
e. Evidence for Water on Mars
f. Orbit and Rotation Rate of Mars
g. The Moons of Mars
h. Evolutionary History of Mars
13. Jupiter
a. Physical Properties of Jupiter
b. Interior Atmosphere of Jupiter
c. Upper Atmospheric Features of Jupiter
d. Orbit and Rotation Rate of Jupiter
e. Magnetosphere of Jupiter
f. The Moon System of Jupiter
g. The Galilean Moons: Io, Europa, Ganymede, and Callisto
h. Tidal Heating
14. Saturn
a. Physical Properties of Saturn
b. Interior Atmosphere of Saturn
c. Upper Atmospheric Features of Saturn
d. Orbit and Rotation Rate of Saturn
e. Magnetosphere of Saturn
f. The Rings of Saturn
g. Roche Limit
h. The Moon System of Saturn
i. The Moon Titan
15. Uranus and Neptune
a. Discovery of Uranus and Neptune
b. Physical Properties of Uranus and Neptune
c. Interior Atmospheres of Uranus and Neptune
d. Upper Atmospheric Features of Uranus and Neptune
e. Orbits and Rotation Rates of Uranus and Neptune
f. Magnetospheres of Uranus and Neptune
g. The Rings of Uranus and Neptune
h. The Moon Systems of Uranus and Neptune
16. Solar System Debris and Dwarf Planets
a. Asteroids
b. Asteroid Belt
c. Effects of Impact with Earth
d. Comets
e. Orbital Lifecycle of Comets
f. Kuiper Belt
g. Oort Cloud
h. Meteoroids, Meteors, and Meteorites
i. Meteor Showers
j. Dwarf Planets
k. Physical Properties of Pluto

17. Extrasolar Planets
a. Detecting Extrasolar Planets
b. Doppler Shift Method
c. Transit Method
d. Direct Imaging Method
e. Properties of the Extrasolar Planets currently known
f. Classifying Extrasolar Planets
g. Habitable Zone
18. The Sun
a. Physical Properties of the Sun
b. Stellar Nuclear Fusion
c. Einstein's Mass-Energy Equation
d. Hydrogen Fusion
e. Hydrostatic Equilibrium
f. Interior of the Sun
g. Core
h. Radiation Zone
i. Convection Zone
j. Photosphere
k. Chromosphere
l. Corona
m. Solar Wind
n. Solar Magnetism
o. "Surface" Features of the Active Sun
19. Measuring the Stars
a. The Solar Neighborhood
b. Parallax
c. Parallax Distance
d. Luminosity and Apparent Brightness
e. Inverse-square Law for Brightness
f. Brightness Distance
g. Magnitude Scale for Brightness
h. Relationships between Stellar Mass, Temperature, Luminosity, Radius, and Life Span
i. Hertzsprung-Russell Diagram
j. Stellar Types
20. Interstellar Medium
a. Interstellar Gas, Molecules, and Dust
b. Physical Properties of the Interstellar Medium
c. Interstellar Reddening
d. Interstellar Extinction
e. Effects of Reddening and Extinction on Observations
f. Nebulae
g. Emission Nebulae
h. Reflection Nebulae
i. H II Regions
j. Molecular Clouds
k. 21-Centimeter Radiation
21. Star Formation
a. Conditions for Star Formation
b. Star Formation Stages
c. Cloud Fragmentation
d. Protostar
e. Protostellar Disk
f. Bipolar Flow
g. Protostellar Winds
h. Zero-Age Main Sequence
i. Initial Mass Function
j. Star Clusters
k. Associations
l. Open Clusters
m. Globular Clusters
22. Stellar Evolution of Low Mass Stars
a. Main Sequence Stage
b. Core Hydrogen Fusion
c. Red Giant Stage
d. Shell Hydrogen Fusion
e. Helium Flash

f. Core Helium Fusion
g. Horizontal Branch Stage
h. Asymptotic Branch Stage
i. Planetary Nebula Stage
j. White Dwarf
k. Electron Degeneracy Pressure
l. Observing Stellar Evolution in Star Clusters
m. Future Evolution of the Sun
23. Stellar Evolution of High Mass Stars and Stellar Explosions
a. Supergiants
b. Stellar Fusion of Elements up to Iron
c. Helium Capture
d. Why Stars cannot Fuse Elements Heavier than Iron
e. Core-Collapse Supernovae
f. Supernova Fusion of Elements heavier than Iron
g. Neutron Capture
h. Supernova Remnants
i. Neutron Stars
j. Neutron Degeneracy Pressure
k. Black Holes
l. Schwarzschild Radius
m. Cycle of Stellar Death and Rebirth
n. Enriching the Interstellar Medium
24. The Milky Way Galaxy
a. Variable Stars
b. Period-Luminosity Relationship
c. Variable Star Distances
d. Structural Components of the Milky Way Galaxy
e. Galactic Disk
f. Galactic Bulge
g. Galactic Halo
h. Galactic Center
i. Supermassive Black Hole
j. Orbital Motions of the Milky Way Galaxy's Components
k. Spiral Arms
l. Spiral Density Waves
m. Galactic Rotation Curve
n. Keplerian Rotation Curve
o. Flat Rotation Curve
p. Dark Matter
q. Galactic Dark Matter Halo
r. Formation and Evolution of the Milky Way Galaxy
25. Galaxies and Hubble's Expansion Law
a. Hubble Classification System for Galaxies
b. Elliptical Galaxies
c. Bulge Spiral Galaxies
d. Barred Spiral Galaxies
e. Irregular Galaxies
f. Lenticular Galaxies
g. Active Galaxies
h. Active Galactic Nucleus
i. Galaxy Clusters
j. The Local Group of Galaxies
k. Hubble's Expansion Law
l. Hubble's Constant
m. Cosmological Redshift
n. Cosmological Distances
26. Galaxy Formation and Large Scale Structure
a. Galaxy Interactions
b. Galaxy Mergers
c. Behavior of Stars, Gas, and Dark Matter during Galaxy Mergers
d. Hierarchical Galaxy Formation
e. Large Scale Structure
f. Redshift Surveys
g. Galaxy Superclusters
h. Voids
i. Walls and Filaments

j. The Observable Universe
k. Dark Matter's Role in the Formation of Galaxies and Large Scale Structure
27. Cosmology
a. Cosmology
b. Hubble's Expansion Law and the Expanding Universe
c. Big Bang Theory
d. Cosmic Microwave Background
e. The Fate of the Universe
f. The Geometry of Space
g. Critical Density
h. Closed Universe Model
i. Open Universe Model
j. Critical Universe Model
k. Accelerating Universe
l. Dark Energy

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 to face
onlien with some required face to face meetings (hybrid)
online course with on ground testing
iTV

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?

The assignments and evaluations are the same for the delivery methods chosen.

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)

discussio forums
message
email
newsgroup/discussion borad
proctored exam
telephone

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 course with LMS interface.

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