AST R101: INTRODUCTION TO ASTRONOMY

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
AST - Astronomy

Course Number (CB01B)
R101

Course Title (CB02)
Introduction to Astronomy

Banner/Short Title
Introduction to Astronomy

Credit Type
Credit

Start Term
Fall 2021

Catalog Course Description
This course is an introduction to astronomy for both science and non-science students. The intent of the course is to familiarize each student with the terms, tools, and theories of modern astronomy. Topics covered include historical events and discoveries, personalities, and tools, as well as studies of the solar system, stars, galaxies, pulsars, and blackholes. The scientific method is defined and expounded.

Taxonomy of Programs (TOP) Code (CB03)
1911.00 - Astronomy

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
52.5
Maximum Contact/In-Class Lecture Hours
52.5

Activity

Laboratory

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
105
Maximum Outside-of-Class Hours
105

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Students will be able to describe an active Sun in terms of sunspots, 11 and 22-year solar cycles linked to Sun's magnetic field, prominences, coronal holes, solar flares and coronal mass ejections.
2	Students will be able to describe the theory of contraction of a nebula into a rotating disk and planetary accretion.
3	Students will be able to define and use the Equatorial Coordinate System.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Describe the history of astronomy, the practical applications of astronomy, and the more important tools of astronomy; for example, the use of a telescope.
2	Define the terms and theories of modern astronomy; for example, the Equatorial Coordinate System.
3	Describe what astronomy is and is not, what it encompasses, and the benefits of studying it.
4	Explain the nature of our solar system, our galaxy, and the universe as a whole, e.g., stars, including binaries, variables, and main sequence stars; stellar evolution; interstellar objects; and galaxies.
5	Describe the basic concepts of matter and energy, such as atoms, mass, inertia, gravity, photons, kinetic and potential energy.

Course Content

Lecture/Course Content

1. History and Personalities of Astronomy
   a. Discoveries by ancient Greek astronomers and philosophers
   b. The five major players in the Copernican revolution
   c. Dalton, Maxwell, Rutherford, Bohr, Einstein, Hubble, Schwarzschild, and others
2. Astronomical Techniques, Methods, and Tools
   a. Types of telescopes and their properties
   b. Spectroscopes, how they work, analysis of spectra
   c. Doppler effect
   d. Light detectors such as the eye, photographic film, CCD chips

   e. Radio telescopes
   f. Space telescopes for Infrared, Ultraviolet, X-rays, and gamma rays
   g. Parallax for determining distance
3. Matter and Energy
   a. Concept of scalars and vectors with applications such as mass, speed, time, velocity, acceleration, force, momentum, and energy
   b. Structure of matter, including protons, neutrons, electrons, Bohr model, energy states
   c. Photons, wave length/color, quantum energy, absorption and emission
   d. Kinetic and potential energy
   e. Thermal energy and temperature
   f. States of matter: solid, liquid, gas, plasma
   g. Blackbody radiation Planck curve
4. Formation of the Solar System
   a. Types of solar system objects: planets, asteroids, comets, meteoroids
   b. General properties of these objects, direction of revolution and rotation, etc.
   c. Hypothesis for the formation of planetary systems coincident with the birth of their stars, and evidence to support this hypothesis
   d. The theory of contraction of a nebula into a rotating disk and planetary accretion
   e. Comparative planetology: terrestrial planets and gas giant planets
   f. Evidence for planets outside our solar system
5. Earth and Moon
   a. Gross properties: size, mass, density, temperature, albedo, etc.
   b. Igneous, sedimentary, metamorphic rocks
   c. Seismic waves probe the interior
   d. Interior structure: inner and outer cores, mantle, crust, lithosphere, asthenosphere
   e. Source of energy: Impacts during formation melted the planet, caused differentiation, current heat from radioactive decay
   f. Plate tectonics: differences between sea floor and continents, earthquakes, volcanoes, Pangaea
   g. Atmospheric composition and structure, ozone layer
   h. Greenhouse effect and the role that CO2 and H2O play in it
   i. Origin and history of Earth's atmosphere, role of liquid water
   j. The Moon: its description and theories for the Moon's origin
   k. Age of the Earth/Moon system, half life of radioactive elements and radioactive dating
   l. Geologic time scales: when did life begin, when were the dinosaurs, the KT layer and other mass extinctions
6. The Other Terrestrial Planets
   a. What we know about Mercury, its density, temperature, surface features
   b. Venus, its size, rotation, dense atmosphere of CO2, temperature, volcanoes and meteor craters
   c. Mars: surface features, volcanoes, meteor craters, Valles Marineris canyon, evidence of early water and of present water-ice, polar caps, robotic exploration
7. The Outer Planets
   a. Jupiter: its size, mass, density, rotation rate, atmospheric composition, differential rotation cloud belts and zones
   b. Model of Jupiter's interior and source of thermal radiation
   c. The Galileo space vehicle and atmospheric probe
   d. Jupiter's major moons and their properties: Io has active volcanoes, Europa and Ganymede may have oceans of liquid water under their icy crusts
   e. Saturn: its size, mass, density, rotation rate, atmospheric composition compared with that of Jupiter
   f. Model of Saturn's interior and source of its excess thermal radiation
   g. Saturn's ring system
   h. The Cassini space vehicle and the Huygens probe into Saturn's moon, Titan
   i. Saturn's moon Enceladus may have liquid water beneath its icy crust
   j. Descriptions of Saturn's other moons
   k. Uranus and Neptune, their size, mass, density, and proposed interior structure
   l. Uranus tilted on its side
   m. Neptune has moon Triton with geysers of nitrogen gas
8. Asteroids, Comets, Meteroids, and Kuiper Belt Objects
   a. Structure, size, shape, and composition
   b. Origins of asteriods
   c. Collisions with planets and moons

   d. Orbits of commets
   e. Comets and their tails
9. The Sun
   a. Gross properties: size, mass, density, surface temperature, rotation period
   b. The Sun is the nearest star
   c. The Sun's atmosphere – Quiet sun: photosphere, chromosphere, Transition zone, corona
   d. The Active sun: sunspots, 11 and 22 year solar cycles, linked to sun's magnetic field, prominences, coronal holes, solar flares, coronal mass ejections
   e. Composition
   f. The age of the Sun and its source of energy – thermonuclear fusion, the Proton – Proton reaction
   g. The Sun's interior, physics the basis for solar models
10. Characterizing Stars
   a. Distances to the stars, stellar parallax, magnitude scale, inverse square law for radiation
   b. Observed properties: temperature, composition
   c. Classifying stars: spectral classification, the Hertzsrprung-Russell (H-R) diagram, luminosity classes, calculated sizes of stars, spectroscopic parallax
   d. Fundamental properties: composition, luminosity, diameter, mass
   e. Binary star systems and stellar mass, types of binary stars
   f. The relationship of stellar mass and the H-R diagram
11. The Evolutionary Life of Stars from Birth through Middle Age
   a. Protostars and pre-main-sequence stars
   b. Main sequence and giant stars
   c. Observational evidence: the H-R diagram for star clusters
   d. Variable stars: RR Lyrae and Cepheid variables, used to determine distance
   e. Mass transfer in close binary star systems
12. The Death of Stars
   a. Evolution of a low-mass star,
   b. The death of high-mass stars: develop into super giants with iron cores, finally explode as supernovae
   c. Two types of supernovae: type I - detonation of a carbon white dwarf in a binary star system; type II - collapse of iron core in an old high-mass star
   d. Creation of heavy elements, injection of heavy elements into nebulae that later form new star systems
   e. Neutron stars and pulsars
13. Black Holes
   a. Relativity theories, special relativity, general relativity – the warping of space-time
   b. Event horizon with singularity
   c. Rotating and non-rotating black holes
   d. Evidence for black holes
   e. Gamma ray bursts
14. The Milky Way Galaxy
   a. Shape and size of the Milky Way
   b. Structure, mass, and number of stars
   c. Stellar populations I and II
   d. Mapping with radio waves
   e. The Sun's speed around the Milky Way
   f. The Galactic center
   g. The future of the Milky Way
15. Galaxies
   a. Discovering Galaxies
   b. Measuring Properties of Galaxies
   c. Dark Matter
   d. Active Galaxies
   e. Quasars as Probes of Intergalactic Space
   f. Galaxy Clusters
16. Cosmology
   a. Observations of the Universe
   b. Evolution of the Universe
   c. The Shape of the Universe

d. The Origin of the Universe and the Big Bang Theory
e. The Inflation of the Universe

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

Audio-visual presentations
Computer-aided presentations
Distance Education
Instructor-guided interpretation and analysis
Lecture

Describe specific examples of the methods the instructor will use:

1. Audio Visual Presentation: The instructor may use videos and PowerPoint like presentations to deliver course content.
2. 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 the motion of our solar system.
3. Demonstrations: The instructor will demonstrate physical principals and phenomena by employing equipment and other items. For instance, when studying the phases of the moon, an Earth, Sun, moon model can be used to how and why we observe portions of the illuminated disc.
4. Distance Education: When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meeting will be used to allow students to ask questions regarding the course and its material.
5. Instructor guided analysis: The instructor will work through exercises and problems during lecture that investigate a given circumstance or 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 current applicable material.
6. Lecture: The instructor will deliver the course subject matter via in person lectures to the students. For example; Stellar evolution and types of stars.

Representative Course Assignments

Writing Assignments

1. Students will write short answer and essay responses regarding questions pertaining to the materials discussed in lecture and reading assignments.

Critical Thinking Assignments

1. Answering a wide array of homework, quiz, and exam questions requiring the analysis of a given system or circumstance in order to come to the correct conclusion and/or answer regarding the question. For instance; Compare and contrast the phases of the moon with the phases of Venus as viewed from Earth. Include an explanation of the variation in light intensity throughout the different phases with the Sun's relative position in mind.

Reading Assignments

1. Students will read approximately 30 pages per week from the textbook and some brief instructor-prepared handouts.

Other assignments (if applicable)

1. Students will produce numeric responses for questions requiring calculations pertaining to the materials discussed in lecture and reading assignments.

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook amounting to approximately 1.5 hour per week.
2. Assigned conceptual and problem solving based homework that further investigates and explores the notions and theories discussed throughout the course. A typical homework assignment will take 4.5 hours.
3. Studying and preparing for quizzes and exams.

Articulation

Comparable Courses within the VCCCD

AST M01 - An Introduction to Astronomy
AST V01 - Elementary Astronomy

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

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

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 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Arny, T., & Schneider, S. (2020). *Explorations, Introduction to Astronomy* (Special). New York, McGraw-Hill.

Resource Type
Other Instructional Materials

Description
Such as Instructor-prepared handouts, slides, videos, and demonstrations. Slides (Viewgraph or PowerPoint) come from current or former textbooks, or are instructor-prepared from personal astronomy photos or from the Internet. VHS videos are complimentary copies from “Coast Astronomy Telecourse Series”..

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.
E-mail	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.
E-mail	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
09/03/2020

Technical Review
10/14/2020

Curriculum Committee
10/14/2020

Curriculum Committee
12/09/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000156964

DOE/accreditation approval date
MM/DD/YYYY