



ANTELOPE VALLEY COLLEGE

Academic Affairs Office  
Course Outline of Record

**COURSE SUBJECT & NUMBER:** ASTR 101L

**COURSE NAME:** \*Astronomy Laboratory

**COURSE UNITS:** 1

**COURSE HOURS:** 3

**COURSE REQUISITES:** *(Follow format of similar courses found in the college catalog.)*

Advisory: Eligibility for College Level Reading, and ENGL 101.

Prerequisite: Completion of ASTR 101 or concurrent enrollment. Completion of MATH 102.

**COURSE DESCRIPTION:** *(Write a short paragraph providing an overview of topics covered. Be sure to identify target audience--transfer, major, GE, degree/certificate, etc. If repeatable, state the number of times at end of description).*

Laboratory applications of principles discussed in ASTR 101. Classroom activities and topics include the use of star charts, cause of the seasons, telescope observations of the Moon, planets, and stars; the laws of optics as related to telescopes, how light is analyzed to deduce the physical properties of stars and galaxies, Kepler's laws of planetary motion, constructing Hertzsprung-Russell diagrams to organize stellar data, cosmic distances, and the Hubble Law as it relates to the age and size of the Universe. (CSU, UC, AVC)

**COURSE OBJECTIVES:** *(Should be stated as performance-based, measurable expected student outcomes. Use Bloom's taxonomy to formulate clear and concise objectives. These objectives are common to all students; they must be clearly related to course content, assignments, and methods of evaluation.)*

**Upon completion of course, the successful student will be able to:**

1. Formulate small and large numbers in scientific notation, and solve mathematical expressions involving them.
2. Contrast the use of units commonly used in astronomy to express quantities of distance and time.
3. Diagram the position of stars in the night sky with the use of constellation charts.
4. Inspect the rising, transit, and setting of stars and planets with the use of a star wheel, and compose an observing schedule to view these objects.
5. Distinguish motions of the Earth's orbit and rotation that are responsible for the seasons.
6. Analyze planetary orbital data to appraise Kepler's laws of planetary motion, and apply to determine the mass of Jupiter.
7. Measure the focal length of a telescope, and use that information to determine magnification and field of view.
8. Describe the formation of stellar spectra, and explain how stellar spectra are used to determine the physical properties of stars.
9. Utilize the Doppler shift of stellar spectra to determine the rotational period of a star.
10. Appraise the heliocentric model of the solar system, and use it to explain the retrograde motion of the outer planets.
11. Inspect the methods of triangulation to determine distance and apply this knowledge to the use of stellar parallax.
12. Measure stellar parallax from figures of stellar fields to determine the distance to nearby stars.
13. Plot stellar temperature and luminosities in the form of a Hertzsprung-Russell diagram, and analyze position of stars on the diagram to infer the properties of local stars and very bright stars.
14. Extend the use of Kepler's laws of planetary motion to explain the motion of binary star systems and calculate the mass ratios of such systems based on radial velocity data.
15. Understand the basic set-up and design of telescopes, and use them to observe the Moon, planets, double star systems, bright nebula, and galaxies.
16. Construct diagrams of the Moon, and identify lunar features based on nighttime telescope observations.
17. Use the period-luminosity relationship for Cepheid variable stars to determine the distance to star clusters and nearby galaxies.

18. Extend the use of Kepler's Laws of planetary motion to explain the rotational curve of a galaxy, and appraise such data to infer the existence of dark matter halos around them.
19. Plot cometary data to illustrate certain salient features of the orbits of comets and their appearances as viewed from the Earth.
20. Evaluate the redshift data of galaxies to appraise the Hubble Law, and use to determine the distance of far away galaxies and determine the current estimate for the size and age of the Universe.

Course Subject & Number: ASTR 101L  
Course Name: \*Astronomy Laboratory

**COURSE CONTENT:** *(Enter course content in terms of specific topics or a specific body of knowledge that each instructor must cover. Put topics in outline form with major and minor headings. Title 5 requires that each instructor covers all material listed here.)*

System of Units	Stellar Spectra
Significant figures	Continuous spectra
Scientific notation	Temperature
Rounding numbers	Blackbody radiation
	Wien's law
Units for Distance and Time	Absorption spectra
Astronomical unit	Doppler shift
Parsec	
Light-year	Retrograde Motion
Megaparsec	
Nanometer	Stellar Parallax
Angstrom	
	Hertzsprung-Russell Diagram
Angular Size	Stellar classification by temperature
	Stellar classification by luminosity
Coordinate Systems	Apparent and absolute visual magnitude
Right Ascension/Declination	Main-sequence properties
Altitude/Azimuth	Bright star properties
Longitude/Latitude	Local star properties
Angle Measures	Spectroscopic Binaries
Decimal degree mode	Relative velocity
Degree-Minute-Second mode	Mass ratios
Systems of Time	Lunar Features
Pacific Standard Time (PST)	Maria
Daylight Saving Time (DST)	Craters
Universal Time (UT)	Rilles
Star Wheel/Constellation Charts	Variables Stars
Rising/Transit/Setting times for stars	Cepheid variables
Planetary positions	RR Lyrae
	Period-Luminosity relationship
Seasons	
Perihelion and aphelion distance	Galactic Rotation Curves
Length of the day and night	Mass of a galaxy
Position of the noon sun	Evidence for dark matter
Position of the sun and sunset and sunrise	
	Cometary Orbits
Kelper's Third Law of Planetary Motion	Comet tails
Planet distances from the Sun	Meteor showers
Planet orbital periods and speed	Radiant
Calculating Jupiter's mass	
	Stellar Rotation
Telescopes	Doppler broadening
Refracting/Reflecting telescopes	
Objective/Aperture	Hubble Law
Magnification	Galactic redshift
Focal length	Expansion rate of galaxies
Field of view	Age and scale of the Universe
	Hubble constant

Course Subject & Number: ASTR 101L

Course Name: \*Astronomy Laboratory

### **TYPICAL READING, WRITING, AND COMPUTATIONAL HOMEWORK ASSIGNMENTS**

*This material is necessary for all credit courses. Assignments should be clearly related to course objectives, content, and methods of evaluation. (See sample of a “Model Outline” in the AP&P Standards & Practices handbook.) Include a range of assignments (minimum of three) from which faculty may choose when designing their syllabus.*

**1. Describe nature and frequency of typical reading assignments if applicable; note if any are required:**

No reading assignments outside of class required. Some lab activities may include assignment sheets that the students must read at the beginning of each laboratory session.

**2. Describe nature and frequency of typical writing assignments if applicable; note if any are required:**

During laboratory activities students are required to make a record of any experiments or investigations being performed in order to answer any questions asked in the laboratory handouts for that day. In the case of optional night time outdoor lab assignments, students take notes on the procedure and activity that is being performed. At the conclusion of the night time outdoor labs, student must write a one page report describing what was observed and how it was observed.

**3. Describe nature and frequency of typical computational assignments if applicable; note if any are required:**

Computational assignments will be a part of every lab activity, excluding night time outdoor activities. Student are required to bring a scientific calculator to lab. Computational assignments include the use of scientific notation, exponents, fractions, square roots, and logarithms. On occasion, students are asked to plot data on a two dimensional coordinate plane using both standard x,y coordinates and polar coordinates.

**4. Describe other types of assignments that students may be asked to complete:**

Students are required to use star charts to locate objects in the night sky. Students are asked to setup and operate telescopes to observe the Moon, some planets, and star clusters.

**5. If course is degree applicable/transfer, describe those critical thinking skills that are required; be sure that they reflect course objective. (Title 5 requirements can be found in the AP&P Standards and Practices book.)**

Diagram, analyze, formulate, calculate, and estimate. Students are typically asked to predict behavior and then analyze a set of data to determine the nature of physical laws and principles. Theories are tied closely with observation and predictions to show evidence for the validity of such laws and principles.

**6. For categories 1-4 above,  describe the estimated time per week it would take a student to complete typical out-of-class assignments. The Carnegie formula uses a 2:1 ratio as follows: 1 hr. lecture = 2 hrs. homework; 2 hrs. lecture = 4 hrs. homework; etc. For example: reading text—2 hours; writing reports—3 hour; etc.**

**Reading:** 0

**Writing:** 1

**Computational:** 0

**Other:** 0

Course Subject & Number: ASTR 101L  
Course Name: \*Astronomy Laboratory

**METHODS OF INSTRUCTION:** *(Methods must be consistent with content and appropriate to objectives; state in terms of what instructor will be doing in order to present course content to students.)*

Short lectures at the beginning of laboratory session to introduce certain basic principles and explain lab procedure. Students are assigned in groups of 2-3 students to work together to complete the lab activity. Instructor spends time with each group guiding and supervising the lab activities and procedures.

**METHODS OF EVALUATION:** *(These must be clearly related to course content, assignments, and objectives, in order to comply with Title 5 requirements. Describe what instructor will be looking for when evaluating assignments and tests in order to determine whether students have met course objectives. Grades must be based on demonstrated proficiency in subject matter and determined, where appropriate, by essays, objective and essay tests, research papers, problem solving exercises, or skills' demonstrations.)*

Each weekly lab assignment is evaluated based upon the student's completion of the lab assignment and understanding of the content. Evaluation based on content depends upon the student's ability to interpret lab procedure results by analyzing that data in the form of graphs or diagrams, and the ability of the student to answer questions regarding those activities and results.

**Suggested Texts or other Instructional Materials (include title, author, publisher, date, and edition):**

Active Learning Astronomy for Astronomy: the Evolving Universe, Zeilik, Cambridge University Press, 2002, Ninth Edition  
Introductory Astronomy: Lab Manual, Shipsey I. et al., McGraw-Hill, 2005, Sixth Edition  
Introductory Astronomy Laboratory Manual, Lind & Plendl, Thomson Learning, 2000, Second Edition  
Introductory Astronomy Laboratory Manual, Summers D. J. & Aitala E. M., McGraw-Hill, 1997, Fourth Edition  
[http://aa.usno.navy.mil/data/docs/RS\\_OneDay.html](http://aa.usno.navy.mil/data/docs/RS_OneDay.html), U.S. Naval Observatory, Daily solar and lunar data

**Effective Date:** \_\_\_\_\_

(date course can first be offered to be filled in by Office of Academic Affairs)