Laboratory Contact Hours: 48-54; Outside-of-Class Hours: 0; Total Student Learning Hours: 48-54

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Astronomy C1001L – Introduction to Astronomy Lab

3 hours laboratory, 1 unit

Catalog Description
This laboratory course reinforces fundamental principles and concepts of astronomy by applying the scientific method through experiments, observations, and/or simulations.

Students gain practical experience with planetary, stellar, and lunar observations, celestial coordinates, and the use of basic astronomical instruments. Formerly ASTR 112, not open to students with credit in ASTR 112.

Prerequisite
None

Co-requisite
Completion of or concurrent enrollment in ASTR C1001 or other locally approved astronomy lecture course

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Define and use the following terms: planet, moon, comet, constellation, Celestial Sphere, precession, seasons, astronomical unit, parsec, light-year.
2) Use synodic and sidereal time.
3) Use the inverse square law as it applies to light and gravity to calculate distance, mass and intensity.
4) Identify the phases of the moon and to use them to predict the time of sunrise and sunset.
5) Compare and contrast solar and lunar eclipses.
6) Diagram the structure of the solar system.
7) Explain the relationship between photons, atomic structure and spectral lines.
8) Discuss stellar distances by using absolute and apparent magnitude and parallax.
9) Construct a Hertzsprung-Russell diagram and use it to analyze the evolution of stars.
10) Compare stellar evolution models for different mass stars.
11) Discuss galactic distances by using various distances indicators.
12) Evaluate models of the structure and evolution of the Universe.

Course Content
Part 1:
This is a lab only course.

Laboratory Content
Part 1:
Content will include:
1) Celestial sphere
2) Orbits and Kepler's Laws
3) Spectroscopy
4) Lunar properties

5) Telescopes and optics
6) Hertzsprung-Russell Diagram
7) Sun features
8) Deep sky objects
9) Cosmic distance ladder

Part 2:

1) Coordinate systems (right ascension and declination)
2) Planet retrograde motion
3) Planet orbits (study ellipses)
4) Sidereal time, local mean time, mean solar time and Universal time
5) Apparent and absolute magnitude and parallax
6) Observe and identify the spectra of atoms and some molecules
7) Blackbody radiation curve
8) Proper motion
9) Spiral arm indicators
10) Red shift and the expansion of the Universe
11) Observe the phases of the Moon and/or observe the Sun
12) Observe Jupiter, Saturn, Mars, and/or Venus
13) How to use star charts
14) Observe stars and multiple star systems
15) Observe Messier object

Course Objectives

At the conclusion of this course, the student should be able to:

Part 1:

1) Collect, analyze, and interpret astronomical data to draw and communicate valid scientific conclusions.

Part 2:

1) Operate telescopes and related instruments to observe celestial objects; apply coordinate systems, parallax, and magnitude relationships to determine positions and distances.
2) Identify and classify astronomical phenomena using spectra, H–R diagrams, and other observational tools.
3) Design experiments using the scientific method.
4) Demonstrate laboratory technique by collecting data using both traditional and computer data acquisition methods; use computers to interpret and analyze numerical data and generate a visual representation of the data.
5) Evaluate scientific theories based on evidence, and present findings in clear, well-organized laboratory reports using proper astronomical terminology and data representation.

Method of Evaluation

Part 1:

Examples of potential methods of evaluation used to observe or measure students' achievement of course outcomes and objectives could include but are not limited to, quizzes, practicums, laboratory activities, laboratory reports, projects, research demonstrations, etc.

Methods of evaluation are at the discretion of local faculty.

Part 2:

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

1) Quizzes and exams that measure students' ability to recognize astronomical and physical concepts, situations, and the vocabulary associated with them.

2) Lab technique as demonstrated by students' ability to design an experiment, set up the equipment, make the appropriate measurements, and maintain a safe work environment.
3) Lab reports that demonstrate students' ability to use the English language; to record, interpret and analyze data; and to draw conclusions from the results.

Special Materials Required of Student
Calculator, planisphere

Minimum Instructional Facilities
1) Smart lab with demonstration equipment, computers
2) Dark site for telescope observations

Method of Instruction
1) Integrated lecture, demonstration and discussion
2) Small and large group discussion
3) In-class activities and independent homework, research projects
4) Auxiliary use of study groups, peer tutoring and/or instructional office hours
5) Computer-facilitated instruction

Out-of-Class Assignments
1) **Reading:** Lecture notes; textbook chapters; lab manuals; vetted web content.
2) **Writing / Problem Solving:** Lab report drafts and final reports; completion of classroom projects/exercises begun in class.
3) **Other:** At-home data collection; field observations; practice in identifying constellations and the use of a planisphere.

Texts and References
Texts used by individual institutions and even individual sections will vary.
- Fraknoi, A. (2016 & Web 2021). A Compilation of Free Laboratory Activities for Astronomy 101 Courses. OER: OER Commons. Institute for the Study of Knowledge Management in Education. https://www.merlot.org/merlot/viewMaterial.htm?id=1374772
- Tuttle, S. (2016 & Web 2024). Distant Nature: Astronomy Exercises. OER: OER Commons. Institute for the Study of Knowledge Management in Education. https://oercommons.org/authoring/17181-distant-nature-astronomy-exercises
- Simulation Curriculum Corporation. (2024). Starry Night College Astronomy Lam Manual. 8th ed.: Simulation Curriculum Corp.
- Locally developed lab manual

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Use a telescope to observe the various astronomical objects within the solar system, within the Milky Way Galaxy and beyond.
2) Demonstrate how luminosities of particular astronomical objects are determined and used to find distances to luminous astronomical objects in general, and how these distances are used in delineating the structure of the Universe.
3) Identify elements in stellar spectra, and use stellar spectra to classify stars.
4) Based upon an experimental scientific investigation conducted in class, write a well-organized formal laboratory report, utilizing proper scientific terminology and English grammar/composition, that presents and analyzes data, and draws appropriate conclusions that demonstrate understanding of basic concepts and terms in astronomy.