El Camino College

COURSE OUTLINE OF RECORD - Official

I. GENERAL COURSE INFORMATION

Subject and Number: **Astronomy 12**
Descriptive Title: **Astronomy Laboratory**

Course Disciplines: **Physics/Astronomy**

Division: **Natural Sciences**

Catalog Description: The astronomy laboratory provides students with an introduction to the observation of the sky with telescopes, binoculars, and the unaided eye. The student will become familiar with the principles of set up and operation of telescopes and use them to view the Moon, the Sun, planets, stars, star clusters, and nebulae. The student will use the principles of astronomy to interpret their observations. Students will also learn to identify the bright stars and major constellations visible in California.

Note: This course is offered only at night.

Conditions of Enrollment: **Prerequisite**

Astronomy 20 or

Astronomy 20H or

Astronomy 25 or

Astronomy 25H
with a minimum grade of C in prerequisite or

Concurrent Enrollment

Course Length: [X] **Full Term** [ ] **Other (Specify number of weeks):**
Hours Lecture: **0 hours per week** [ ] **TBA**
Hours Laboratory: **3.00 hours per week** [ ] **TBA**
Course Units: **1.00**

Grading Method: **Letter**
Credit Status **Associate Degree Credit**

Transfer CSU: [X] **Effective Date: Prior to July 1992**
Transfer UC: [X] **Effective Date: Fall 2007**

General Education:
El Camino College:

1 – Natural Sciences

Term: Other: Approved

CSU GE:

B1 - Physical Science

Term: Other: Approved

B3 - Laboratory Sciences

Term: Other: Approved

IGETC:

5C - Science Laboratory

Term: Fall 1991 Other:

II. OUTCOMES AND OBJECTIVES

A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. Using a Cassegrain reflecting telescope, students will be able to align the telescope and point it at several objects, including the Moon, planets visible to the naked eye, planets invisible to the naked eye, bright stars, faint stars, and diffuse objects (clusters, nebulae, and galaxies).
2. Students will be able to apply the Scientific Method to the solution of astronomical problems.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Use the Scientific Method to investigate an astronomical observation.

   Laboratory reports
2. Make observations and measurements and collect the date.

   Laboratory reports
3. Interpret the results and draw appropriate conclusions from the data.

   Laboratory reports
4. Estimate errors in the data and in numerical results computed from the data.

   Quizzes
5. Write a technical lab report.

   Laboratory reports
6. Recognize and identify the major constellations, planets and bright stars visible from California.

   Oral exams
7. Apply knowledge of the sky to identify the directions north, south, east, and west anywhere in the northern hemisphere.

   Oral exams
8. Set up and orient a small to medium-sized telescope.

   Field work

9. Compare the designs of refracting and reflecting telescopes and their properties such as field of view, magnification, light gathering power, and resolution.

    Quizzes

10. Use a celestial co-ordinate system to locate a variety of objects in the sky with a small telescope.

    Laboratory reports

11. Use the stellar magnitude system to compare star brightness.

    Laboratory reports

12. Identify and measure or estimate physical sizes of major surface or atmospheric features of celestial objects, for example, the Sun, the Moon, open and globular star clusters, galaxies and nebulae.

    Laboratory reports

13. Interpret the physical properties of stars using the properties of light.

    Quizzes

14. Observe and interpret phase appearances of planets.

    Laboratory reports

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lab	16	I	Astronomical Concepts A. Scientific Methods, Measurements, and Interpretation B. Telescopes 1. Optical Design 2. How to Use C. Digital Cameras, Data Aquisition, and Data Reduction D. Celestial Coordinate System 1. Identification of Brightest Stars 2. Constellation Identification 3. Use of a Star Atlas 4. Polar Alignement and Use of Telescopes
Lab	16	II	Visual Observation of Celestial Objects A. Sun, Moon and Planets B. Star Clusters C. Binary Stars
Lab	16	III	Imaging A. Nebulae and Galaxies B. Star Clusters C. Moon D. Planets
Lab	6	IV	Observation of Real and Apparent Motions A. Sun 1. Rotation 2. Seasonal motion in the sky (optional) B. Moon/phases 1. Hourly (optional) 2. Weekly

			C. Planets and their satellites 1. Orbital Motion of Satellites 2. Rotation (if possible) 3. Relative to the Stars (optional) D. Asteroids (optional) E. Constellations 1. Diurnal 2. Seasonal
Total Lecture Hours	0		
Total Laboratory Hours	54		
Total Hours	54		

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. **PRIMARY METHOD OF EVALUATION:**

Problem solving demonstrations (computational or non-computational)

B. **TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:**

Observation of star clusters

1. Select clusters to observe. Use a star chart to make sure they will be above the horizon this evening. Find them in the star atlas to familiarize yourself with their surroundings.

2. Set up a telescope and polar align. Set the right ascension circle.

3. Find your cluster and select the magnification that enables you to see it best.

4. Sketch what you observe in the telescope in your lab notebook.

5. Note whether the cluster is an open cluster or a globular cluster. Note whether the cluster is resolved, that is, whether you can see individual stars. Estimate how big across the cluster is, in minutes of arc (How big is your field of view?). Record all observations in you laboratory notebook.

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1. MOTION OF THE MOON

PURPOSE: In this lab exercise, you will learn how the Moon moves among the fixed stars.

PROCEDURE:

1) Ecliptic longitude is the position of the Moon along the ecliptic. Ecliptic latitude is how many degrees north or south of the ecliptic the Moon is located. Using the table of positions of the Moon for this month, plot the positions of the Moon on the SC1 Constellation Chart. To measure the latitudes, copy the degree scale from the chart onto another piece of paper, and use that to measure the latitudes. When you are finished, connect the dots with a straightedge.

2) Refer to the chart of New Moons for this year. What is the date of the new moon in January. Compute the day numbers of next 12 new moons by adding 29.5 to each day.

3) Using the table calendar for this year, find the day of the month corresponding to each day number.

4) Using your star chart, find the longitude of the Sun on each of the new moon dates.

5) In the space below, diagram the Sun and the Moon on the SC1 Constellation Chart for each of the new moon dates. The Sun goes on the ecliptic and the Moon on its orbit. Diagram the Sun and Moon the same size as 5th magnitude stars. Select the days on which solar eclipses occur. Judge which eclipse occurs at the Moon's ascending node and which at the descending node?

6) Compute the dates of the next three eclipses in the Saros series for each eclipse.

1._____

2._____

3._____

2. SELECTING NEBULAE AND GALAXIES FOR OBSERVATION

PURPOSE: In this lab exercise, you will use your star atlas to come up with a list of nebulae and galaxies to observe and record in your laboratory notebook.

PRACTICE: Using your star atlas, inspect the object at each of the following

coordinates, assess whether it is a planetary nebula (P), a diffuse nebula or H II region (H II), a galaxy (G), an open cluster (OC), a globular cluster (GC) or a reflection nebula (R). Identify the constellation in which it is located.

NAME: CO-ORDINATES: KIND: CONSTELLATION:
M15 21h 30m +12

Ring Nebula 18 54 +33

Crab Nebula 5 34 +22

M45 3 47 +24

Sombrero 12 40 -11

North American
Neb 20 59 +44

Eskimo Nebula 7 29 +21

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Other exams
Quizzes
Laboratory reports
Other (specify):
Short answers

V. INSTRUCTIONAL METHODS

Demonstration
Discussion
Laboratory

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. WORK OUTSIDE OF CLASS

Course is lab only - minimum required hours satisfied by scheduled lab time and estimated student hours outside of class per week is zero.

Estimated Independent Study Hours per Week: 0

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
David Vakil. Astronomy Laboratory Manual. ECC Bookstore, 2005.
Qualifier Text: discipline standard,
Leon Palmer. Trained Sky. 1st ed. Rigel, 2011.

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**
Wil Tirion. Bright Star Atlas, Willman-Bell, 2006.

D. **OTHER REQUIRED MATERIALS**
Chandler. Night Sky Planisphere, David Chandler Co., 1977.

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification
Course Prerequisite Astronomy-20 or	Standard Requisite see attached
Course Prerequisite Astronomy-20H or	Standard Requisite
Course Prerequisite Astronomy-25 or	Standard Requisite
Course Prerequisite Astronomy-25H	Standard Requisite

B. Requisite Skills

Requisite Skills
List the basic precepts of the Scientific Method. ASTR 25H - Compare and contrast the scientific method to pseudo science. ASTR 20 - Judge whether a particular study is science or a "pseudo-science" using the scientific method. ASTR 25 - Judge whether a particular study is a science or a "pseudo-science" using the scientific method.
Distinguish between planets and stars. ASTR 25 - Explain how electromagnetic radiation and astronomical instruments are used to reveal the properties of stars and galaxies. ASTR 25H - Explain how electromagnetic radiation and astronomical instruments are used to reveal the properties of stars and galaxies ASTR 20H - Compare the characteristics of the major planets and major moons of the solar system. ASTR 20 - Compare the characteristics of the major planets and major moons of the Solar System.
Describe the effect of the apparent motion of the Sun, (the Moon and other planets) along the ecliptic as a consequence of the Earth’s orbital motion. ASTR 20H -

Predict the phase of the Moon and/or type of eclipse that would be seen in the sky, given the positions of the Earth, the Sun, the Moon, and the observer. ASTR 20 - Predict the phase of the Moon and/or type of eclipse that would be seen in the sky, given the positions of the Earth, the Sun, the Moon, and the observer. ASTR 25H - Describe the solar cycle and how it affects the Sun and the Earth. ASTR 25 - Discuss the solar cycle and how it affects the Sun and the Earth.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by A. Cockrum, J. Garrison, E. Baldwin on 11/01/1962.

BOARD APPROVAL DATE:

LAST BOARD APPROVAL DATE: 07/18/2016

Last Reviewed and/or Revised by Thanh-Thuy Bui on 02/11/2016

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