

**ARTICULATION AGREEMENT**

**DATE DRAFTED:** June 16, 2020

**VALID ACADEMIC YEARS:** 2020-21 & 2021-22

**LMC COURSE:** ASTRO-010 Introduction to Astronomy

**HIGH SCHOOL COURSE:** Astronomy and Space Science

**School:** Deer Valley High School

**Address:** 4700 Lone Tree Way, Antioch, CA 94531

**A. COLLEGE COURSE DESCRIPTION:** Astronomy and Space science is a survey of the modeling of the Universe and the development of the scientific method of solving problems in the context of astronomy. An emphasis is placed on experimental design, modeling, and observation, simulation, and connecting astronomy through interdisciplinary activities to other topics. The ethical implications of science and multicultural views are also considered.

**B. UNITS:** 3

**C. PRE-REQUISITES:** NA

**D. REQUIRED CONTENT FOR ARTICULATION:**

Unit I: Classical Astronomy

Constellations

Lookback time, light years

Planisphere

Constellation figures, regions, asterisms

Constellation mythology

Proper star names, Bayer letters, Flamsteed numbers, Catalog numbers

Earth's Rotation

Sunrise, sunset

Poles, equator, time zones

Real vs. diurnal motion

Celestial coordinates

Earth's Revolution

Seasons misconception

Orbit shape, perihelion, aphelion

Cause of seasons, diurnal paths

Ecliptic, zodiac, solstices, equinoxes

Moon's Revolution

Origin of word "month"

Orbit shape, perigee, apogee

Cause of phases

Limb, terminator, lit side, dark side

## Unit II: Methods and Tools

### Scientific Method

Astrology vs. astronomy

Steps, cycle

Hypothesis, model, theory

Hallmarks

### History of Solar System Model

Annual motion, direct/retrograde motion

Ptolemy, geocentric, deferents epicycles

Copernicus, heliocentric

Kepler, ellipse, focus, orbit laws

### Light waves

Examples of waves

Amplitude, wavelength

Visible spectrum

Complete spectrum

### Telescopes

Ray, lens, refract

Objective lens, eyepiece

Telescope powers

Telescope problems

## Unit III: Planets, Solar System

### Solar System Inventory

Sun

Planets, moons

Planetoids, moonlets

Interplanetary substances

### Planet Properties

Terrestrial

Jovian

Dwarf

Reclassification

### Planet Formation

Contraction, nebula

Building steps (condensation, aggregation, accretion)

Differentiation

Collision, evacuation

### Extrasolar Planets

Exoplanet catalog

Wobble method

Dimming method

Drake equation

## Unit IV: Stars, Universe

### Star properties

Parallax

Apparent magnitude, absolute magnitude

Line spectrum, spectral class, line width

H–R diagram

### Galaxy Types

Elliptical

Normal/barred spiral

Lenticular, irregular

Hubble diagram

### Universe

Redshift, distance

Hubble law, Big Bang

Dark matter, dark energy

Universe death

## **E. REQUIRED COMPETENCIES (PERFORMANCE OBJECTIVES) FOR ARTICULATION:**

At the end of Astronomy and Space Science, a student will meet the following Course Student Learning Outcomes:

CLSO 1: Read articles about the definition of a planet, sections of the textbook, and web pages about planets and constellations to extract technical information, stories, and cultural background of mythology related to constellations. Students will present Powerpoints about planets including technical information and interesting facts, and constellation reports emphasize the cultural interpretation of constellations.

Projects: Planet Powerpoint; Constellation report

CLSO 2: Students will write lab reports about experiments; answer writing prompts on assessments related to astronomy, complete an observing notebook with observing projects, create hands-on projects and complete work such as planetarium operator or research projects to demonstrate understanding of the concepts of astronomy.

Project: Observing notebook, Planetarium assistants

CLSO 3: Students will design and carry out lab investigations related to laws of nature, optics, planetary motion and the behavior of light. Critical thinking skills will be developed in group work, through written presentations using real-world and simulated settings.

Labs: Inverse square law, 150 star magnitudes activity, Nova lab, Lens lab, Jupiter Lab, Ellipse lab

CLSO 4: Use interdisciplinary skills in creating reports and participating in class presentations; write about the implications of “Big Ideas” in astronomy such as the Big Bang theory, nucleosynthesis, scale of the universe and special relativity; and brainstorm solutions to problems such as global warming, solar flares, and asteroid impacts.

Project: Save the World

CLSO 5: Possess awareness of how the development of astronomy was guided by the development of critical thinking, the scientific method, and the events embedded in the culture of the time of the scientific discovery.

Project: Essay about Kepler's role in history of science and astronomy

CLSO 6: Students will use inferential reasoning to show how the limited data from starlight is used to draw conclusions about stars and compare and contrast this with the methods used in physical science to conduct experiments.

Projects: Inverse square law lab, stellar spectrum lab, nova lab, 150 stars lab

CLSO 7: Students will learn how to use appropriate technology to create pipelines of data analysis for converting raw observations in to patterns, graphs, and draw conclusions from this data. Students will have opportunities to use telescopes for observing. Students will use mathematical modeling techniques to analyze data from experiments.

Projects: Jupiter lab, inverse square law lab

CLSO 8: Students will explore the financial, ethical and moral imperatives to protect the earth from large-scale threats such as asteroid impacts, global warming, supernovas, gamma ray bursts, and so on.

Project: Save the World

#### F. METHODS FOR END OF COURSE ASSESSMENT:

	In-class Activities	Article Homeworks	Observing Assignments	Oral Report	Unit Tests	Final Exam
CSLO 1	X	X			X	X
CSLO 2	X	X	X	X	X	X
CSLO 3				X		
CSLO 4	X	X			X	X
CSLO 5	X	X			X	X
CSLO 6	X	X			X	X
CSLO 7	X	X			X	X

- A = 90% to 100%
- B = 80% to 89.9%
- C = 70% to 79.9%
- D = 60% to 69.9%
- F = 0% to 59.9%

Credit by exam: Students must receive a grade of "B" or better on the final exam

#### **G. PROCEDURES AND/OR CRITERIA FOR COURSE ARTICULATION:**

1. Complete the Astronomy course at Deer Valley High School with a grade of "B" or better.
2. Receive a "B" or better on the agreed upon college/high school final exam procedure.
3. Be recommended for credit by the high school teacher.
4. Apply for admission at Los Medanos College.
5. Register for CATEMA for electronic recommendation of college credit **within the academic year in which credit was earned.**
6. Upon completion of the above, the student will receive on his/her LMC and CCCCD (California Community College District) transcript the units of credit for LMC's ASTRO0-10 course.
7. College transcripts will reflect the **FINAL EXAM GRADE** earned and will be notated as \*Credit by Exam.

*\*Distance Learning Circumstances:*

*Final Exam "Procedure" will still need to be fulfilled whether the high school class meets in person or moves to a distance learning platform. If the high school class moves to an online learning environment, all efforts will be made to enable students to earn college credit, however due to circumstances beyond the high school/college control, course content may not be able to be completed in order to fulfill the articulation agreement requirements.*

#### **H. TEXTBOOKS OR OTHER SUPPORTING MATERIALS**

- a. Conceptual Astronomy 1 and 2 by Jeff Adkins
- b. Discovering the Universe, Comins and Kauffmann
- c. Optional: Michael Seeds and Dana Backman, ASTRO 2, Brooks/Cole, Cengage Learning, Second Edition, 2014

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**COLLEGE SIGNATURES**

**HIGH SCHOOL/ROP/DISTRICT SIGNATURES**

\_\_\_\_\_  
Natalie Hannum Date  
LMC Vice President of Instruction

\_\_\_\_\_  
Olubukola Oyebade Date  
Principal, Deer Valley High School

\_\_\_\_\_  
Ryan Pedersen Date  
LMC Dean of Mathematics and Sciences

\_\_\_\_\_  
Mike Santos Date  
AUSD Director of Program Improvement

\_\_\_\_\_  
Dennis Gravert Date  
LMC Physical Sciences Department Chair

\_\_\_\_\_  
Christine Ibarra Date  
AUSD Associate Superintendent, Educational Services

\_\_\_\_\_  
Scott Cabral Date  
LMC Faculty

\_\_\_\_\_  
Amy Bettencourt Date  
AUSD Director of Instructional Support

\_\_\_\_\_  
Jeff Adkins Date  
Faculty, Deer Valley High School