LOS MEDANOS COLLEGE

ARTICULATION AGREEMENT **DATE DRAFTED**: May 12, 2022

VALID ACADEMIC YEARS: FA22-SP24

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. **HIGH SCHOOL CLASS DESCRIPTION:** This is an interdisciplinary, integrated, yearlong lab course in which students learn about the earth, the solar system, stars, the galaxy, and the universe. Students also learn about rocket science and living in space, as well as current NASA missions.
Students are expected to bring together and use skills learned in Geometry, Algebra, History, English, and Fine Arts classes as they investigate current research related to various topics, including the history of our planet and solar system and theories about space and space travel. This course uses computers in a variety of ways and provides hands-on lab activities related to the physics and mathematics of astronomy and space science, including computer sensor labs, flying model rockets, and nighttime viewing sessions with telescopes. This course cannot be taken concurrently with Earth Science. Students will be prepared to take the Earth Science California Standards Test.

E. 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

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

F. 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

G. 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

H. TEXTBOOKS OR OTHER SUPPORTING MATERIALS

1. Conceptual Astronomy 1 and 2 by Jeff Adkins
2. Discovering the Universe, Comins and Kauffmann
3. Optional: Michael Seeds and Dana Backman, ASTRO 2, Brooks/Cole, Cengage Learning, Second Edition, 2014
4. http://www.AstronomyTeacher.com This is my personal domain and leads to all the projects and classes I am responsible for.
5. http://www.dvaceacademy.com ACE Academy home page.
6. For astronomy: http://apod.nasa.gov/apod/astropix.html . APOD is the Astronomy Picture of the Day.
7. Stellarium: https://stellarium.org

I. PROCEDURES AND/OR CRITERIA FOR COURSE ARTICULATION:
(all of the following must be met)

1. Students **must apply** to Los Medanos College and register in **CATEMA** in order to receive credit recommendations by their high school teacher.

2. Students **must be recommended** for credit by their high school teacher in **CATEMA.**
Teachers recommend credit at their discretion.

3. Students **must complete** the Astronomy & Space Science at Deer Valley High School with an overall grade of "B" or better.
High school teachers will enter this grade in CATEMA.

4. Students **must earn** a "B" or better on the agreed upon college/high school final exam procedure.
High school teachers will enter this exam grade in CATEMA.

5. Articulated college credit may only be recommended by the high school teacher and received by the student **within the academic year** in which it 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 **ASTRO-010 "Astronomy"** course.

7. College transcripts will reflect the **FINAL EXAM GRADE** earned and will be notated as *Credit by Exam.

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COLLEGE SIGNATURES

Natalie Hannum
Natalie Hannum (May 17, 2022 16:03 PDT)

Natalie Hannum Date
LMC Vice President of Instruction

Ryan Pedersen
Ryan Pedersen (May 17, 2022 15:14 PDT)

Ryan Pedersen Date
LMC Dean of Instruction, Mathematics and Sciences

Mindy Capes
Mindy Capes (May 17, 2022 14:47 PDT)

Mindy Capes Date
LMC Physical Sciences Department Chair

Scott Cabral
Scott Cabral (May 16, 2022 12:38 PDT)

Scott Cabral Date
LMC Faculty

HIGH SCHOOL/ROP/DISTRICT SIGNATURES

Bukky Oyebade (May 28, 2022 20:27 PDT)

Olubukola Oyebade Date
Principal, Deer Valley High School

Lindsay Wisely
Lindsay Wisely (Jun 3, 2022 10:13 PDT)

Lindsay Wisely Date
AUSD Director of Program Improvement

Christine Ibarra (Jun 3, 2022 10:44 PDT)

Christine Ibarra Date
AUSD Associate Superintendent, Educational Services

Amy Bettencourt
Amy Bettencourt (Jun 3, 2022 10:01 PDT)

Amy Bettencourt Date
AUSD Director of Educational Services, Instruction Support

Jeffery Adkins (May 31, 2022 14:20 PDT)

Jeff Adkins Date
DVHS Faculty

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Final Audit Report 2022-06-03

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