**Las Positas College**
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

**Course Outline for ASTR 10**

**INTRODUCTION TO ASTRONOMY: THE SOLAR SYSTEM**

**Effective: Spring 2018**

I. CATALOG DESCRIPTION:
ASTR 10 — INTRODUCTION TO ASTRONOMY: THE SOLAR SYSTEM — 3.00 units

Introduction to history and physical principles of astronomy, focusing on our Solar System. Includes: constellations; distance scales; historical development of astronomy; gravitation; motion of the Earth, Moon, and Planets; astronomical tools; formation and evolution of the solar system; physical properties, atmosphere, and evolution of the Earth, Moon, and planets within the solar system; asteroids, comets, and other small bodies; discovery of extra-solar planets; possibilities for life beyond Earth. Designed for non-majors in mathematics or a physical science. A companion science lab, Astronomy 30, is also available.

3.00 Units Lecture

**Grading Methods:**
Letter or P/NP

**Discipline:**
- Physics/Astronomy

| | MIN |
|---|---|
| **Lecture Hours:** | 54.00 |
| **Total Hours:** | 54.00 |

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

A. review and explain the Scientific Method, as it applies to astronomy;
B. describe and explain the celestial sphere and astronomical coordinate systems;
C. diagram and explain the apparent motion of the planets, moon, sun, and stars;
D. explain the daily and annual motions of the Earth and moon, including tides and eclipses;
E. appreciate the development of astronomical models throughout history, including models from Ancient Greece and Europe, as well the contributions and systems of from Meso-America, China, and the Middle East.
F. describe the types of astronomical tools and spacecraft used in exploration of the solar system;
G. describe current models for the formation and structure of the solar system, as well as the evidence in support of these models.
H. describe general distinguishing properties of Terrestrial and Jovian planets, as well as comets, meteors, and asteroids;
I. describe and identify the structure, composition, and basic physical properties of the Earth.
J. explain the process of the Earths structural and atmospheric evolution from the Accretion era to the present;
K. explain the role of catastrophic impacts in directing the formation and evolution of the Earth and Moon;
L. identify and describe on-going changes to the Earth's atmosphere and biosphere due to the evolution of life, and on-going human activities;
M. describe the structural, geological, and atmospheric properties of the terrestrial worlds, with particular emphasis on factors that led to similarities and differences with the Earth;
N. describe and identify the structural, atmospheric, and magnetic properties of the Jovian Planets;
O. describe the satellites and rings of the outer planets, as well as the processes responsible for their unique characteristics;
P. describe and identify the components and characteristics of the Asteroid Belt, Kuiper Belt, Oort cloud, and other small bodies in the solar system;
Q. summarize the most recent spacecraft exploration of the solar system, as well as likely possibilities for future exploration;
R. describe the distinguishing characteristics of asteroids, comets, meteors, and meteorites;
S. explain the requirements for life in space and the scientific attempts to locate signs of intelligent life outside of Earth;
T. describe the current and future methods involved in the search for extra-solar planets, as well as the characteristics of recently discovered solar systems;
U. identify at least 10 different seasonal constellations and bright stars, as well as planets currently visible in the night sky.

V. CONTENT:
A. The Scale of the Cosmos
1. Astronomy and the Scientific Method
2. Overview of Astronomy
3. Angles and Angular Measure
4. Powers of Ten
5. Astronomical Distances and Scale Models

B. Sky Watching and Apparent Motion of the Heavens
    1. Ancient Astronomy
    2. Constellations
    3. Motions of the Sky
    4. The Celestial Sphere
    5. The Seasons
    6. Precession
    7. Sidereal and Solar time
    8. The Calendar and Astrology
C. Eclipses and the Motion of the Moon
    1. Phases of the Moon
    2. The Moon's Rotation
    3. Eclipses and the Line of Nodes
    4. Lunar and Solar Eclipses
D. Gravitation, Orbital Motion, and the development of Modern Astronomy
    1. Geocentric Models
    2. Copernicus and the Heliocentric Models
    3. Galileo and the Telescope
    4. Tycho Brahe's Observations
    5. Kepler and the Orbits of the Planets
    6. Newton's Laws of Motion
    7. Newton's Laws in Everyday Life
    8. Newton and Gravity
    9. Tides and the Moon
    10. Einstein and relativity
E. The Nature of Light
    1. The Speed of Light
    2. The Wave Nature of Light
    3. Blackbody Radiation
    4. Wien's Law and the Stefan-Boltzmann Law
    5. The Particle Nature of Light
    6. Kirchhoff's Laws
    7. Atomic Structure
    8. Spectral Lines and the Bohr Model
    9. The Doppler Effect
F. Optics and Telescopes
    1. Refracting Telescopes
    2. Reflecting Telescopes
    3. Angular Resolution
    4. Charge-Coupled Devices (CCDs)
    5. Spectrographs
    6. Radio Telescopes
    7. Telescopes in Space
G. Our Solar System
    1. Terrestrial and Jovian Planets
    2. Satellites of the Planets
    3. The Evidence of Spectroscopy
    4. Chemical Composition of the Planets
    5. Asteroids and Comets
    6. Abundances of the Elements
    7. The Origin of the Solar System
    8. The Origin of the Planets
    9. Extra-solar Planets
H. The Earth
    1. The Earth's Energy Sources
    2. Earthquakes and the Earth's Interior
    3. Plate Tectonics
    4. The Earth's Magnetic Field
    5. The Earth's Evolving Atmosphere
    6. Humans and the Earth's Biosphere
I. The Earth's Moon
    1. The Moon's Airless Surface
    2. Voyages to the Moon
    3. The Moon's Interior
    4. Moon Rocks
    5. The Formation of the Moon
J. Mercury
    1. Mercury as Seen from Earth
    2. Mercury's Curious Rotation
    3. Mercury's Cratered Surface
    4. The Interior Structure of Mercury
K. Venus
    1. Venus as Seen from Earth
    2. Venus's Retrograde Rotation
    3. Venus's Oppressive Atmosphere
    4. Volcanoes on Venus
    5. Climate Evolution on Venus
    6. Geology on Venus
L. Red Planet Mars
    1. Mars as Seen from Earth
    2. Speculations about Canals
    3. Craters, Volcanoes, and Canyons
    4. Dry Lakes and Polar Ice Caps
    5. Climate Evolution on Mars
    6. Landing on Mars
    7. The Martian Seasons
    8. The Moons of Mars
M. Jupiter
    1. Jupiter as Seen from Earth
    2. Jupiter's Clouds

3. Jupiter's Weather Systems
4. Probing Beneath Jupiter's Clouds
5. Jupiter's Rocky Core
6. The Interior Structure of Jupiter
7. Jupiter's Magnetosphere

N. The Galilean Satellites of Jupiter
1. The Satellites as Seen from Earth
2. Sizes, Masses and Densities
3. Formation of the Galilean Satellites
4. Io's Active Volcanoes
5. Electric Currents in Io
6. Europa's Icy Crust
7. Cratered Ganymede and Callisto
8. Jupiter's Small Satellites and Ring

O. The Saturnian System
1. Saturn as Seen from Earth
2. Saturn's Icy Rings
3. The Structure of the Rings
4. Shepherd Satellites
5. Saturn's Atmosphere
6. The Interior Structure of Saturn
7. Saturn's Internal Heat
8. Titan
9. Saturn's Other Satellites
10. New Missions to Saturn

P. The Outer Worlds
1. Discovering Uranus and Neptune
2. Weather and Seasons on Uranus
3. Cloud Patterns on Neptune
4. Inside Uranus and Neptune
5. Magnetic Fields of Uranus and Neptune
6. Rings of Uranus and Neptune
7. Uranus's Satellites
8. Triton
9. Discovering Pluto
10. Pluto and Charon

Q. Vagabonds of the Solar System
1. The Discovery of the Asteroids
2. Jupiter and the Asteroid Belt
3. The Nature of the Asteroids
4. Impacts on Earth
5. Classifying Meteorites
6. Meteorites and Our Origins
7. Comets
8. The Origin of Comets
9. Comets and Meteor Showers

R. The Search for Extraterrestrial Life
1. Building Blocks of Life
2. Life in the Solar System
3. Meteorites from Mars
4. The Drake Equation
5. Radio Searches
6. Infrared Searches

## VI. METHODS OF INSTRUCTION:

A. **Classroom Activity** -
B. **Field Trips** -
C. **Discussion** -
D. Directed dark sky observations
E. **Lecture** -
F. **Projects** -

## VII. TYPICAL ASSIGNMENTS:

Typical assignments may include:

A. weekly or bi-weekly textbook readings
B. weekly or bi-weekly take-home video quizzes
C. weekly or bi-weekly homework problems
D. special topic projects a few times per semester (Special topic projects may range from performing night-sky observations, attending star-parties or planetarium shows, and/or writing a research paper on a topic of astronomical interest.)

## VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Quizzes
3. Papers
4. Class Participation
5. Class Work
6. Home Work

B. **Frequency**

1. Quizzes may be given weekly, biweekly, or at the discretion of the instructor.
2. Exams may be given 2-4 times per semester.
3. A research paper may be turned in once per semester, at the discretion of the instructor.
4. Class participation and classwork may be evaluated during every class, or at the discretion of the instructor.
5. Homework may be assigned weekly, biweekly, or at the discretion of the instructor.

IX. TYPICAL TEXTS:

1. Chaisson, Eric, and Steve McMillan. *Astronomy Today.* 9th ed., Pearson, 2018.
2. Bennett, Jeffrey, Megan Donahue, Nicholas Schneider, and Mark Voit. *The Cosmic Perspective.* 8th ed., Pearson, 2017.
3. Kay, Laura, Stacy Palen, and George Blumenthal. *21st Century Astronomy.* 5th ed., W. W. Norton & Company, 2017.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Computer access, through purchase of a Computer Use Card at LPC, or access to a personal computer at home or work with an Internet connection.